Factory
Management and Maintenance

VOL. 95, NO. 8 — AUGUST, 1937

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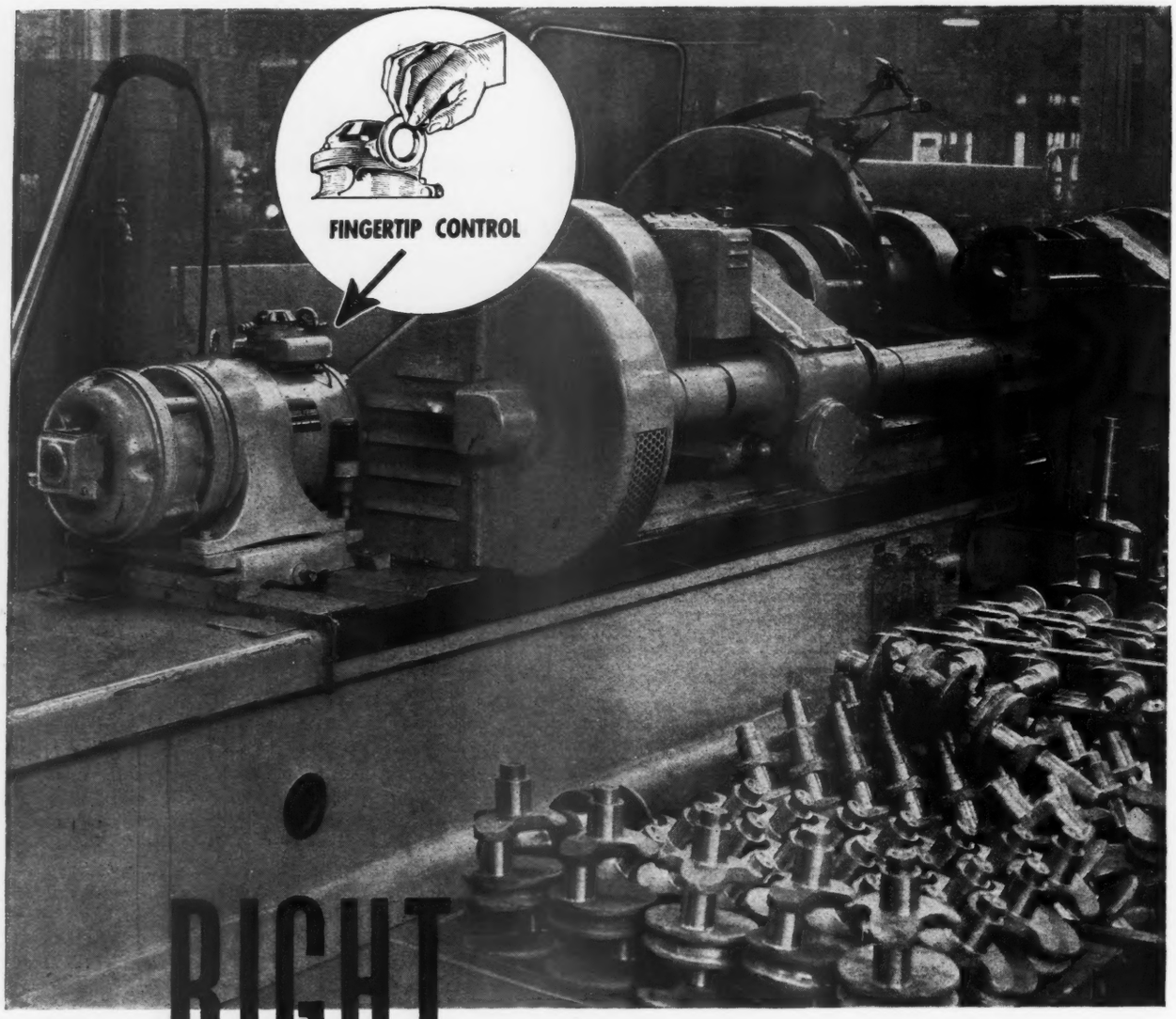

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Factory
Management and Maintenance

L. C. MORROW • EDITOR

No Peace Until–

AMENDMENT or repeal of the Wagner Labor Law is imperative. The things that happened in the labor situation during the past thirty days left no doubt in the public mind.

There were several indications that public disapproval of those chaotic labor conditions had at last impressed the administration.

1. In reference to recent CIO labor controversies, President Roosevelt uttered the sentence: "A plague o' both your houses." Significant is the word "both," because it has not been unusual for employers to be reprimanded.

2. Secretary of Labor Perkins took a belated stand against the sit-down strike.

3. Secretary of Commerce Roper, in a statement presumably inspired or approved, pointed out the necessity for organized labor to accept responsibility as well as "rights."

4. The Labor Standards Bill was revised to eliminate its worst features, including those reinforcing the Wagner Labor Law.

By these statements, and by this revision, recognition was given of public dissatisfaction with legislation that is not impartial or not economically sound. More specifically, it was recognized that public opinion is opposed to the attempts of CIO to make use of a one-sided law to take by force what it is morally entitled to seek only by peaceful means.

FACTORY contended from the beginning that the country was in for trouble if Congress passed the Wagner bill. We have stated and we repeat the Wagner Labor Law has been responsible for many of the strikes fought along unprecedented and unlawful lines. We believe the economic loss and bloodshed that the country has suffered would have been prevented if there had been no law at all or a law fair to both sides.

We contend now that the law, if it is not to be repealed altogether, should be amended to take the government out of a partisan position, to fix the responsibilities as well as the rights of labor, and to give the country a chance to forge ahead in this period of prosperity.

"Amend the Wagner Act"

L. C. MORROW
Editor

ON FRIDAY, July 9, I mailed to 1,000 of *Factory's* subscribers copies of the "Ballot on Wagner Labor Act," which is reproduced on the opposite page.

The date is significant. Order had been restored, or nearly so, in the steel centers. Comparative calm reigned on the labor front. Judgment could be passed, and ballots voted, without the influence of fresh reports on militant mass picketing, property seizure, worker intimidation, dynamitings, interference with mail delivery, pitched battles.

Table I. Summary of Votes by Titles

President	19
Vice-President	27
Secretary or Treasurer	8
Manager (Gen'l, Plant, Works)	100
Superintendent	106
Production Manager	14
Miscellaneous	31
Total	305

One week later, a count of the ballots that had been voted in this comparative calm, showed an almost unanimous condemnation of the Wagner Labor Law as it stands now on the statute books. But let the summary entered on the ballot reproduction speak for itself.

What kinds of people are these who voted, and where do they live? All of them belong to the "management" personnel of the manufacturing industries. Their titles and the number of voters for each title are shown in Table I. Table II shows their geographical distribution.

The voters are so nearly in accord that there is no detectible difference of conviction whether the voter is "big-shot" or not so big. Nor does it make any apparent difference whether or not he is from a state where the battle has raged.

Three hundred and five ballots represent a 30 per cent return. That is a good percentage for a questionnaire—especially good in this case because they came back within a week. More are coming in daily; they will continue to dribble in for some time.

It was the intention to send out many more if the voting was close. But there was nothing close about it, so I consider that the returns are representative of the convictions of management in the manufacturing industries. This is true because *Factory's* subscribers constitute a true cross-section of management in the manufacturing industries and because the names of the subscribers who received ballots were selected *at random* from our list of subscribers.

How They Commented

Some voters accepted our invitation to comment by writing on the reverse side of the ballot. I quote all that we have room for without comment of my own, for obviously no interpretation is needed.

Executive Vice-President—Pennsylvania. "Question 11—Present laws are adequate on this point to protect both striking and non-striking employees."

Vice-President, in charge of Manufacturing — Michigan. "Wishing to qualify my answers to the first two questions, would say that in the first case, while the answer is *No* I believe that it is a temporary situation. In the second case the answer is *Yes*, but again it is a temporary situation.

"The Wagner Act is a good start toward defining labor relations and in itself is not to be blamed for results. The blame lies with those who see a wonderful opportunity to become powers in the labor movement and political world by deceiving the working man.

"The changes must eventually be made in the law which will clear up and well define the rights of all concerned. The difficulties experienced in the meantime are the price we pay for learning, and to a certain extent are to be expected."

General Manager—Ohio. "The entire act is a mistake, it being a political maneuver which interferes with and obstructs industrial progress. Labor should not be permitted to assume managerial functions without a corresponding transfer of responsibility (which it is not qualified to undertake)."

General Manager—Missouri. "The questions are just a trifle pointed . . . so much so they almost appear to be framed to bring the answers we might want. Otherwise very okay."

General Manager — Massachusetts. "No. 11—If a strike is called by a majority vote of all employees, *No*; otherwise, *Yes*."

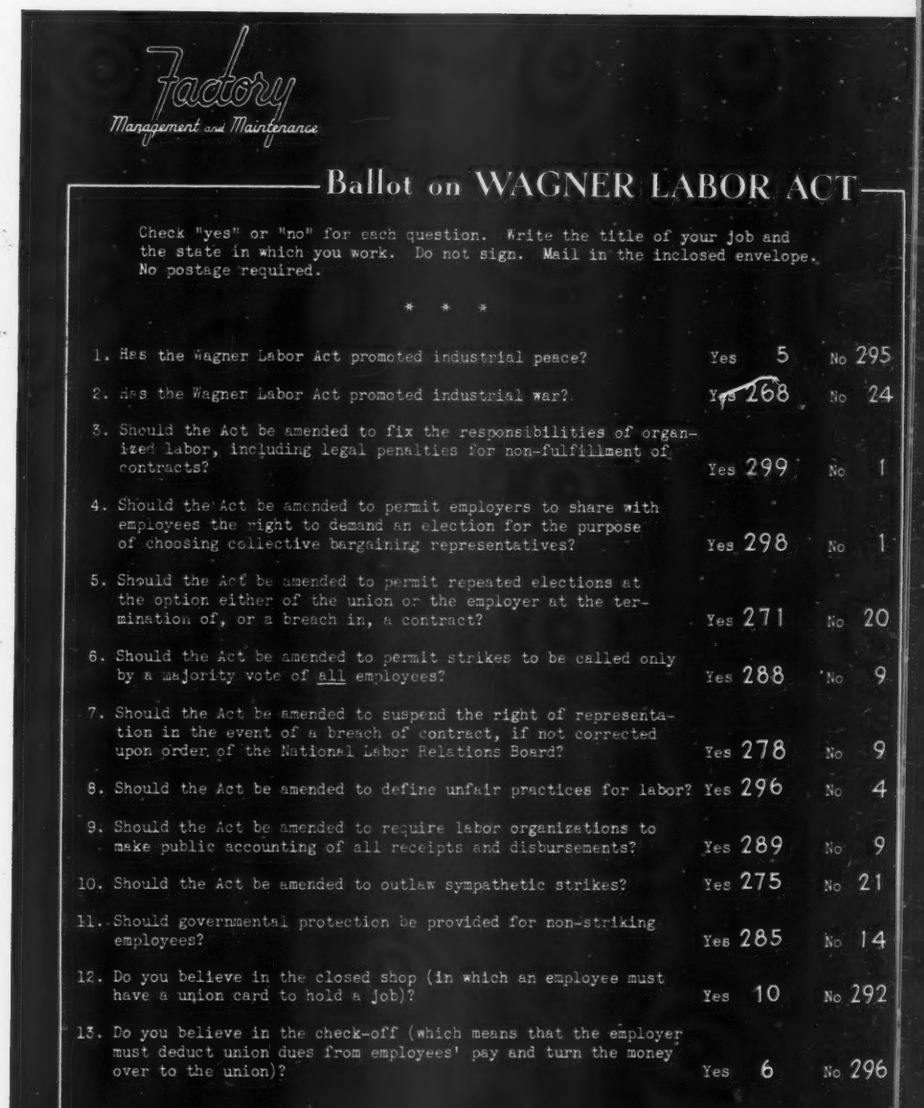
Works Manager — Ohio. "NLRB elections are in many cases not elections or choice of alternatives in representation due to wording of 'ballot.' **Misrepresentation* as to government's desires, pressure of coercion, threat and outright violence on part of unscrupulous and often communistic 'organizers' brings about a 'sign-or-else' condi-

Table II. Summary of Votes by States

California	15
Connecticut	15
Illinois	23
Indiana	20
Massachusetts	12
Michigan	28
New Jersey	17
New York	34
Ohio	31
Pennsylvania	27
Wisconsin	19
Miscellaneous[1]	64
Total	305

[1] States with 10 votes each or less: Ala., Colo., Del., Ga., Ia., Ken., La., Me., Md., Minn., Mo., Mont., Neb., N.H., N.C., Okla., Ore., R.I., Tenn., Tex., Va., W.Va.

Says Management



Factory
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Ballot on WAGNER LABOR ACT

Check "yes" or "no" for each question. Write the title of your job and the state in which you work. Do not sign. Mail in the inclosed envelope. No postage required.

* * *

1. Has the Wagner Labor Act promoted industrial peace?	Yes 5	No 295
2. Has the Wagner Labor Act promoted industrial war?	Yes 268	No 24
3. Should the Act be amended to fix the responsibilities of organized labor, including legal penalties for non-fulfillment of contracts?	Yes 299	No 1
4. Should the Act be amended to permit employers to share with employees the right to demand an election for the purpose of choosing collective bargaining representatives?	Yes 298	No 1
5. Should the Act be amended to permit repeated elections at the option either of the union or the employer at the termination of, or a breach in, a contract?	Yes 271	No 20
6. Should the Act be amended to permit strikes to be called only by a majority vote of all employees?	Yes 288	No 9
7. Should the Act be amended to suspend the right of representation in the event of a breach of contract, if not corrected upon order of the National Labor Relations Board?	Yes 278	No 9
8. Should the Act be amended to define unfair practices for labor?	Yes 296	No 4
9. Should the Act be amended to require labor organizations to make public accounting of all receipts and disbursements?	Yes 289	No 9
10. Should the Act be amended to outlaw sympathetic strikes?	Yes 275	No 21
11. Should governmental protection be provided for non-striking employees?	Yes 285	No 14
12. Do you believe in the closed shop (in which an employee must have a union card to hold a job)?	Yes 10	No 292
13. Do you believe in the check-off (which means that the employer must deduct union dues from employees' pay and turn the money over to the union)?	Yes 6	No 296

Title of your job_____ State in which you work_____

(If you wish to comment, use blank side of ballot)

tion; and a *No* on a SWOC-CIO ballot, if known to CIO terrorists, spells plenty of abuse, grief, and misery. So vote *Yes*, pay your money (if you can't avoid it, and you can't and avoid plenty of hell), take it and like it."

*"Perhaps I'm wrong; our 'class antagonism' preaching executives may want every worker in one big union, may want the $500,000 contribution raised to several million and Tammanyize the Federal Government. Farley knows how and will miss relief army votes if such a substitute is not provided. Perhaps it is not misrepresentation that 'four departments of the government want you to join CIO.'"

Works Manager—Wisconsin. "No. 7—This would not be feasible if No. 6 is operative and majority of employees approved representatives' action. If majority does not have opportunity to approve representatives' action the answer is *Yes*."

Works Manager—New Jersey. "Regarding first two questions, believe that cause of many instances of trouble in recent past is that Wagner Act is not being used by either side. Believe after a year or so it will be easier to answer this question definitely."

Paper Mill Manager — Indiana. "I think that unions should be made responsible for all their acts. They are in a lot of cases doing a larger cash business than lots of companies—with no responsibility. Make them incorporate and stand by agreements made."

Factory Manager — New Jersey. "Some phase of the law with teeth should protect an employee from being forced to join an organization by any form of coercion either inside the plant or outside in his private life and home.

"It is believed the employer should be fully protected as to property, mob violence, and the new curse of sound truck propaganda.

"I'm still young enough to want to live in a country where individual initiative counts for advancement and is not regulated by a central government committee's whims and favor.

"In any true American sport both sides abide by the same rules."

Production Manager—Illinois. "Labor unions should be required to incorporate for the protection of members against exploitation by leaders as well as fixing financial responsibility for any damages done through strikes."

Superintendent — North Carolina. "Present conditions of the Wagner Act are in no way practical and are a great menace to industry. Our representatives in Congress and Senate should forget politics for a while and correct these laws so they are applicable on a 50-50 basis."

Superintendent — New York. "One of the principles of organization is 'That with delegation of responsibility must go a commensurate delegation of authority.' Conversely, with delegation of authority I believe should go delegation of responsibility."

(*Continued on page 148*)

Acme

WHEN REPUBLIC opened its gates after six weeks of idleness, the number of people who punched the clock gave evidence that a willful minority had engineered the whole costly business. Should not the Wagner Act be amended to permit strikes to be called only by a majority vote of *all* employees? Turn back the page to see how management voted on this question

Getting Along with the Union

As another of *Factory's* contributions to current management practice, the editor sent a member of the staff to Akron to get this important story. It describes the collective bargaining techniques developed over a period of a good many months by a well-known rubber concern and the Rubber Workers' Union

ARTHUR VAN VLISSINGEN, JR.
Consulting Editor

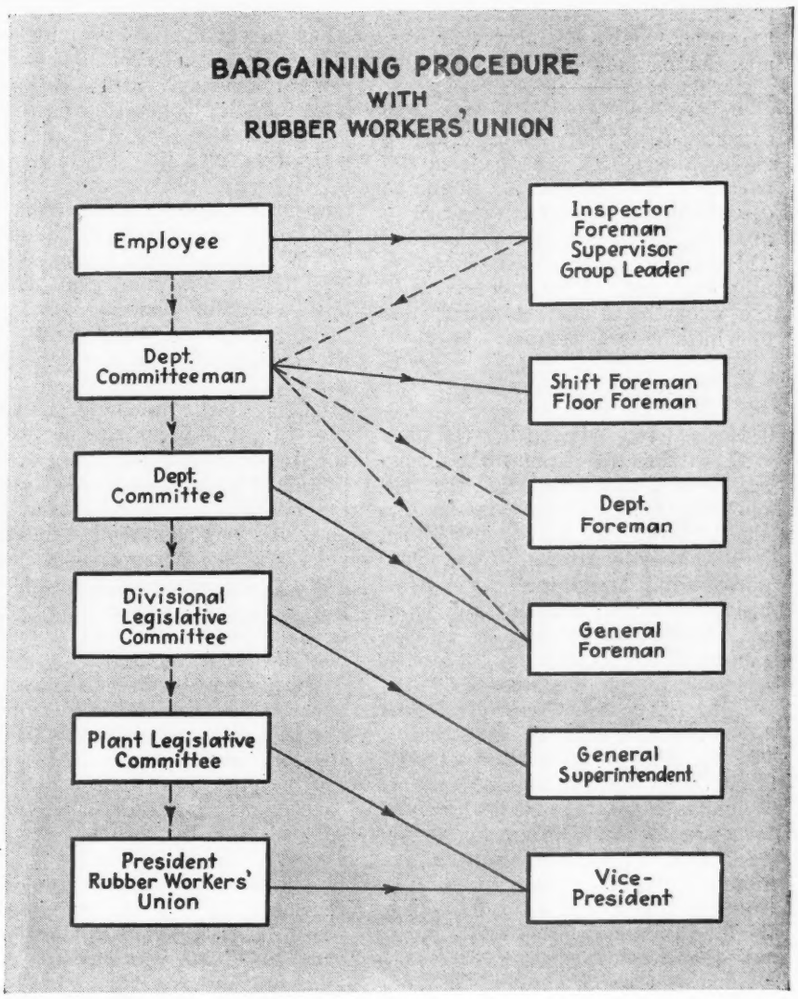
WHAT THIS COUNTRY seems to need at the moment even more than a good five-cent cigar is a handbook on the most effective methods and procedures for bargaining collectively. Industrial executives without previous experience in such activities are sitting down to bargain with workers who are equally innocent of first-hand knowledge of how the act is best performed. Results cannot be so satisfactory as if both sides to the bargaining were equipped with a recognized technique.

Even though the representatives of the employees are part of an old and long-established union, the chances are that theirs is a relatively new local with officers who are novices in the field. When the union happens to be one of the more recently fledged internationals, or a smaller and more localized independent group, it is still less likely that its local officials are familiar with how best to proceed toward smooth, effective settlement of the questions which arise. The industrial executive who has some idea of a workable bargaining technique, and gets this procedure accepted by both sides, is assisting his employees to express themselves clearly and is helping himself by cutting out an amount of lost motion.

A Technique That Works

One of the large rubber companies in Akron has had a comparatively long experience in dealing with one of the newly organized CIO unions, that of the rubber workers. Company officials and officers of the local union which has its membership in the Akron plants, were newcomers to the field of collective bargaining. Over the months there has developed a method of procedure which has worked rather more satisfactorily than have many companies' first attempts.

In the troubled atmosphere of Akron's strikes and sit-downs and close-downs, this company has operated with no major difficulties and with only a few spontaneous and unauthorized departmental stoppages, none of which lasted much



more than a couple of working days.

Everyone concerned makes such remarks with his fingers crossed and with frequent rappings on wood, since what is going to happen seems utterly unpredictable. Company officers and executives refuse to be specifically quoted, lest their words be misconstrued. But the fact remains that the record to date as this is written in mid-July indicates that the working procedure which has been evolved has both satisfied the workers and also permitted the employer to operate without burdensome restrictions.

The chart reproduced on page 53 shows in briefest possible form the procedure by which a question for negotiation—usually termed a grievance—is handled.

If the individual employee does not like something about his job and thinks it should be changed, he takes it up with his immediate superior. Failing to obtain satisfaction, he goes to his department committeeman, the union representative in his department. There may be two or three such committeemen in the present organization of the union in the department and the worker may pick the one he knows best or thinks most likely to get results.

An interesting point is that the department committeeman serves as representative only of his own department; no matter how small the department, it is not represented by a committeeman in another section. This committeeman, when he takes up a case, goes to the supervision of the department he represents and of which he is a member.

Regular Channels

If the grievance touches relations with another department, the transaction must follow through the regular channels of the organization chart, never cut across the chart, lest thereby confusion and misunderstanding creep in. And in all collective bargaining, the evil to be most scrupulously shunned is misunderstanding which may grow to unlooked-for proportions.

Any grievance or problem before becoming a matter of dispute must be reduced to writing, numbered, and approved by the union. In actual practice, this means that the department committeeman goes over to union headquarters after working hours and gets some help in writing up his grievance. This complaint is now numbered by the union office and comes up for consideration by the union; unless the union approves the grievance, it does not come up for negotiation.

As a matter of routine and to speed handling, the union runs off an extra copy of the complaint, with its number, and shoots this over to the man in the company management who serves as assistant in this field to the vice-president under whose jurisdiction fall industrial relations. The complaint comes to this man just as soon as it has been numbered, and approved by the union.

With His Immediate Superior

The first step in handling the problem is that the department committeeman takes it up with his immediate superior, who may be an inspector, foreman, supervisor, or group leader. If the problem is not settled here, the committeeman then goes to the shift foreman, next to the department foreman, finally to the general foreman.

Suppose he is still unsatisfied or, what amounts to the same thing, his constituent back on the production line is still unsatisfied. He and the other departmental committeemen discuss it at a meeting with the general foreman. Still lacking satisfaction, this committee passes the grievance along to the divisional legislative committee, which takes it up with the general superintendent of that division. And still perhaps it is not settled.

Now there remains just one higher level of appeal. The plant legislative committee, accompanied by the president of the local meets with the designated officer of the company. Such a meeting is not lightly called, since the union officials recognize that their interests as well as the management's are best served by carrying to final appeal only those cases which are important and also on which they feel they have a strong side. With corresponding consideration, the company official is willing to spend upon a given grievance however much of time and negotiation it requires.

During a recent three-month period, the union wrote up and numbered 240 grievances. Of these, 15 were never presented for negotiation; 175 were negotiated to a conclusion by the departmental supervision; 30 were negotiated to a conclusion by the divisional superintendent; 20 were negotiated to a conclusion by the vice-president.

An approximate tabulation of these same 240 grievances by causes is as follows:

145	compensation of groups
10	compensation of individuals
20	hours of work for groups
20	individual seniority status
5	group seniority status
40	working conditions

In the opinion of company executives dealing with grievances and negotiations, with only the rarest of exceptions all complaints arise from one of two basic causes: (1) Desire for more money; (2) misunderstandings.

Money cases can usually be settled finally and satisfactorily to everybody by some straightforward handling such as re-examination of job standards and ironing out the wrinkles which inevitably creep in.

The misunderstandings are the tough ones to handle, since the worker who comes with a preconceived picture which does not coincide with the facts is often in a frame of mind—or emotion—wherein he cannot view the situation dispassionately. Similarly, if

. . . 12 Rules of

1. Set up recognized channels or procedures for bargaining, such as (1) to the foreman, (2) then to the superintendent, and (3) finally to an executive officer of the company.

2. Follow your channels. Don't short-circuit the supervision immediately concerned in the problem. To do so, destroys morale.

3. Be friendly in negotiation. Introduce everybody. Relieve any existing tension. Know at least a little about the personal history of every man in the meeting.

4. Be willing to listen. It is time enough to worry about how you will say "No" *after* you have heard the facts.

anyone in the supervision gets a misunderstanding and acts according to it, the possibilities of violent upset are far greater than in something simple and easily understood such as a mistake about basic rates or production units.

Meet After Hours

It is definitely understood between union and management that a meeting for negotiation is not requested during the working hours of the union committeemen—unless in event of an emergency. Management always tries to work out a time and place which will be entirely convenient to the workers, usually immediately after a shift goes off. This is particularly easy in the rubber industry, with its four six-hour shifts, three of which come close to management working hours. If a meeting is called during a committeeman's shift and he attends, he loses pay for the time thus lost.

Any grievance complaint is answered just as soon as possible, usually within a very few days. If it is a perfectly simple question of fact, the answer comes back to the union representative almost immediately. If it requires study or investigation, the union is promptly told so and given an idea of when this will be completed. If this drags out, then periodic progress reports are made.

Another interesting point which has been developed is that when the services of an outside consultant are required, the union and the company split the costs. For example, on one moot point a professor was called in from a university not very many miles distant, and he spent several days on the job. Then he asked for the help of an industrial engineer without experience in the rubber industry, and such a man was accordingly obtained from an Eastern city. All expenses, plus the fees of the two consultants, were divided equally by the company and the union.

Mind you, this was not arbitration, it was merely fact-finding which the union requested because it questioned the accuracy of the internal rate-setting organization on the jobs in question.

Company executives have developed a definite philosophy on the subject of collective bargaining. This was recently put down by one of these men in the form of notes for a talk to be delivered before a small group. His notes constitute such a homely, commonsense approach to the subject that they are here reproduced in abridged form.

When the company first began to operate under collective bargaining, most factory supervisors found themselves in a rather bewildering position. It appeared to many that the responsibility and authority for handling his department were being taken from him to a large extent and being given to various committees or individuals representing the workers.

Such cases were handled one by one as they came to a head, and endeavors were made to show the men in supervisory positions that their jobs were more important than ever. When the autumn rolled around, and it was time for foreman training work, the foreman training program for 1936-1937 was practically turned over to showing these key men how best they can function under collective bargaining.

By the time the course had gone through two or three sessions, the supervisory unrest ceased. The men began to get the picture, they began to see that while their functions had in some small degree shifted, these functions are now more important than before, and in some ways require a good deal more ability.

No small share of the original bewilderment arose because men above the first-line supervision unintentionally robbed their subordinate foremen of authority in collective bargaining, some in small degree and others on a wholesale scale. Nobody knew, in the early stages, just how to proceed. So, human nature being what it is, he either passed the buck to the man above, or else the man above took the responsibility of his own initiative.

The foreman training course helped to readjust this situation. The foremen were instructed in their

(Continued on page 146)

Collective Bargaining . . . . . .

5. Give everyone an opportunity to state his position. This often discloses the real champion of the problem or grievance.

6. Don't attempt to guide the discussion along a straight line directed to solving the problem. Let it wander at times. Don't hurry it.

7. Use any opportunities to: (a) Educate the committee; (b) help disclose bias or prejudice; (c) show how established company policies make actions necessary; (d) iron out or smooth over any unrelated or related grievances that may come to light.

8. Don't let negotiations reach a stalemate. Help to define the problem and to suggest the solution.

9. If facts disclose a need for more than solving the immediate problem, be willing to go as far as is justified.

10. Be friends as negotiations end. Don't shut the door on further consideration of the problem. Show willingness to listen to new facts when and if developed.

11. Make sure the negotiating committee is agreed on the fairness of the solution of the problem, and that they have sufficient facts to sell their constituents that the solution is a fair one.

12. Make sure every commitment is scrupulously fulfilled. Use a rigid follow-up to guarantee no slip-ups.

Employees Can Form Factory Unions

L. C. MORROW
Editor

EVERY employee wishes to know his rights and duties under the Wagner Act. Down to the present time, he has received a lot of misinformation on the subject from both employers and union leaders. What he needs is advice and information from some fair and impartial person.

The labor leader has an ax to grind, because he wants to build up his union and the income of his union. The employer has an ax to grind, because he wants to avoid labor troubles which are costly.

The facts are these:

Only employers can violate the Act. Employees can not. Nothing that they can do is made unlawful under the Act.

The purpose of the Act is to protect employees from domination, repression, and interference on the part of their employer, in connection with matters of organization and representation.

Fullest Freedom

Employees are free to join an outside union, or to organize and maintain a "company union" or factory union. They have the same right to fight for a factory union that the outside labor leader has to fight for an outside union.

A factory union is just as lawful under the Act as any other union, provided the employees run it and support it. But it must not be dominated or subsidized by the employer. In fact, employees who form a factory union may secure the help of the Labor Board to force the employer to recognize and deal with a factory union, for the purpose of collective bargaining.

On the other hand, it should be remembered that an AFL or a CIO union has no standing under the Act if it is dominated or subsidized by the employer.

The point is this: Employees have fullest freedom in determining what type of union they may wish. The law does not discriminate between factory unions or outside unions. It gives equal rights to each, if they are not dominated or subsidized by the employer. It denies all rights to either type, where it *is* dominated or subsidized by the employer.

Let me make this plain. Phony unions run by the employer have no standing. Honest-to-goodness unions of every kind are upheld. As between different unions, whether they be AFL or CIO or factory unions, the law makes no distinction. It simply must be an *employees'* union and not an *employer's* union.

No employer nor labor leader has the right to drive an employee into the union he (the employer or the labor leader) prefers. That's the employee's own business.

There is nothing in the law to require an employee to join a union that is unfriendly to the employer, or to start trouble with the employer. Friendly and cooperative unions, if they are what employees want, have equal rights.

The only thing the law insists upon is that the employer allow his employees to decide these matters for themselves. On the other hand, employees have a right to seek advice, suggestions, and guidance from their employer. But it should be their desire and not the employer's that brings this about.

Employees must not let any employer tell them otherwise. They must not let any labor leader tell them that a factory union has no rights, or that he is the only person who can protect their rights.

Protected by Law

The rights of employees to organize in their own way are now protected by law. These rights need no other protection. Employees can now do what they want to do without the aid of professionals, without dictation from employers.

CONSTITUTION

ARTICLE I
Object

Section 1. The employees of the .... Company hereby form this association and adopt this constitution, in order to promote their general welfare, to cooperate with the company, and to bargain collectively with the management as to wages, hours, and working conditions.

ARTICLE II
Name

Section 1. The name of this organization shall be ..... Employees Association.

ARTICLE III
Membership

Section 1. All full-time employees (except those who are identified with management or are in supervisory positions) may become members.

ARTICLE IV
Election of Representatives

Section 1. The election of Representatives to the executive committee shall be by secret ballot.

Section 2. Such election shall be through voting groups. Each group shall elect one Representative for each 100 employees, or major fraction thereof.

Section 3. The voting groups shall be as follows:

Section 4. The Executive Committee may change the voting groups and number of Repesentatives by a two-thirds vote of its members.

Section 5. For the purpose of any election, each qualified voter shall be furnished with a blank ballot by the Election Committee. The voter shall write thereon the name of the member or members of the Association he desires to represent his voting group. No more names shall be written on the ballot than the number of Representatives to be elected in the division concerned. The eligible person, or persons, receiving the largest number of votes, shall be declared elected, provided the votes received shall equal a majority of the persons voting.

OF——————EMPLOYEES ASSOCIATION

If, as a result of the foregoing election a vacancy or vacancies still exist because no one is declared elected to fill one or more positions, there shall be a run-off election with only two candidates for each unfilled position. The two candidates for each unfilled position shall be the employees receiving the largest number of votes on the previous ballot. The winner of such run-off election shall be determined in accordance with procedure set forth in previous paragraph.

Section 6. All Representatives so elected, unless recalled, shall hold office for one year, or until their successor or successors are elected.

Section 7. In case of a vacancy in the position of any Representative, said vacancy shall be filled by a special election conducted as in the case of a regular election.

Section 8. A Representative may be recalled by a two-thirds vote of the members of his voting group, taken on petition of not less than one-third of the members of such voting group.

Section 9. The annual election of Representatives shall be held during the second week of ..... in each year. Special elections, and voting on a recall, shall be held on order of the Executive Committee, as required by this Constitution.

Section 10. All elections, annual and special, and all voting on the question of a recall, shall be conducted by the Election Committee, and in accordance with regulations of the Executive Committee.

ARTICLE V

Officers

Section 1. The Executive Committee shall elect from its own members a President, Vice-President, Secretary, and Treasurer, and such other officers as it shall deem desirable, to serve at the will of the Executive Committee. The Treasurer shall be bonded.

Section 2. Each of said officers shall perform the duties usually incident to such offices, except in so far as said Executive Committee shall alter the duties of any office.

Section 3. The Executive Committee shall appoint an Election Committee, and from time to time such other committees as it shall deem wise.

ARTICLE VI

Duties of Executive Committee

Section 1. The Executive Committee shall be vested with full authority to manage the Association and its affairs, subject to the provisions of this Constitution. Through its officers, it shall handle the funds of the Association, collect dues and disburse moneys, keep proper records of all transactions, inform members of all actions taken in their behalf, and shall annually report to the members concerning the affairs of the Association, including an account of receipts and expenditures.

Section 2. The Executive Committee shall hold such meetings as it may deem necessary, and shall call meetings of the Association when petitioned by one-tenth of the members so to do, or when in its judgment such meetings should be called.

Section 3. It shall be the duty of Representatives on the Executive Committee to receive complaints and grievances from the members of the Association in their voting group, and to present the same to the proper representatives of the management for adjustment and settlement, in accordance with the agreed procedure.

Section 4. It shall be the duty of the Executive Committee to engage in collective bargaining with the management, relative to matters of general interest to the members of the Association, but it shall have no power to agree with the employer on any general change in wages, hours, or working conditions which affect a majority, or more, of the members of the Association, except subject to the approval of a majority of the members of the Association on a vote taken at a meeting of the Association duly noticed and called for that purpose.

ARTICLE VII

Dues and Assessments

Section 1. Such funds as are deemed by the Executive Committee to be reasonably necessary to carry on the business of the Association shall be raised from time to time in such manner as may be determined by the Executive Committee, which shall have authority to assess each member $1 each fiscal year. Additional assessments shall be made only upon express direction of a majority vote of the members at a meeting of the Association, but in no event exceeding a total of $5 per member in any calendar year. There shall be no admission fee.

ARTICLE VIII

Amendments and Dissolution

Section 1. This Constitution may be amended by a two-thirds vote of the members of the Association present at any meeting duly noticed for that purpose, provided said notice shall have been given to said members at least one week prior to said meeting, and shall contain a copy of the proposed amendment, or the substance thereof.

Section 2. This Association may be dissolved by a majority vote of the members, provided written notice of such meeting, containing a statement of the proposed action, is furnished to each member at least two weeks prior to such meeting. In the event of dissolution, all funds remaining in the treasury, after the payment of all debts, shall be distributed equally among the members then in good standing.

ARTICLE IX

Temporary Provisions for Starting Organization

Section 1. This Constitution shall be submitted for approval by secret ballot of all employees eligible to membership in the Association, and if approved by a majority thereof, shall thereupon become effective. Such ballot shall be taken under the direction and supervision of the Temporary Committee which formulated the Constitution.

Section 2. If this Constitution is approved by a two-thirds vote taken as provided in this Article, the Temporary Committee shall proceed to obtain applications for membership from eligible employees. After all eligible employees shall have been given an opportunity to sign such application, and a majority of said employees shall have actually signed, the Temporary Committee shall act as a Temporary Election Committee, in the manner prescribed in Article IV, in conducting an election for the first Representatives to the Executive Committee.

It is all very simple. The law protects the rights of employees to organize and be represented by people of their own choosing. They can choose outsiders if they wish. They can run their own affairs without the help of outsiders if they wish.

Up to Employees

It is up to employees to decide these matters for themselves. If they have a fair employer, they will probably not care to turn their problems over to outsiders. If employees want to fight, by resorting to strikes, picketing, and such activities, they may feel a desire to call in outside leaders and prepare for trouble.

Let me repeat, it is up to the employees. If they want an organization of their own, instead of a CIO or AFL union, the course for them to pursue is simple:

1. Appoint an informal committee composed of one or more members from each department.

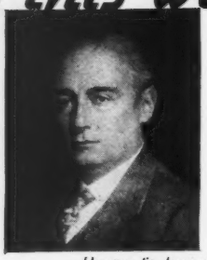
2. Have this temporary committee lay out a program and prepare a draft of a constitution for the new organization. A sample constitution is shown herewith.

3. Submit the program and constitution to a secret ballot of all the employees for their approval or disapproval.

4. If the constitution is approved, have the employees join the new organization and then proceed to the election of the representatives, in accordance with the constitution.

5. Proceed to bargain collectively with the employer.

It's this way in Washington



Harris & Ewing

CARTER FIELD
Washington Correspondent

Wages-and-hours legislation is assured, if not before adjournment, at least before the 1938 elections. But industry can bank on one thing. No starry eyed New Dealers will dot the i's and cross the t's when the final draft is written. It will be a conservative bill

EMPLOYERS might as well recognize—despite the severe reverse President Roosevelt and the New Deal sustained on the Supreme Court enlargement program—that wages-and-hours legislation is assured. The rush for early adjournment may or may not put the measure over until next session, but it is sure of enactment before the 1938 election.

This does not mean that the radicals will be in the saddle when the final text is written. On the contrary the strength of conservatives on Capitol Hill is greater at the moment than at any time since FDR was inaugurated.

Not only are such senators and representatives who are known to entertain conservative views more potent, and less afraid to speak out and force action lest they upset their party apple cart, but they are insisting on drafting their own legislation, instead of getting it with all the "t's" crossed from the Ben Cohen's and the Tom Corcoran's of Brain Trust fame.

Surprise of Their Lives

What may deceive or frighten many about the wages-and-hours bill as it inches its way along on Capitol Hill is the fact that a rather radical group is in control of the House Labor Committee. It rather surprised business men generally that Senator Black, who has been crusading for the 30-hour week, should have brought out such a conservative bill.

The Senate Committee pondered various constitutional difficulties and decided to avoid them. For instance, retail employees, who were included by the House Committee. For instance, virtually making the board an adjunct of the Labor Relations Board, and barging in on the field of collective bargaining by extending its discretion up to a possible minimum of 60 cents instead of 40, and down to 35 hours a week.

There is all sorts of trouble in the House membership about this whole measure.

It is not only a question of the geographical differential. There is a peculiar problem in the cotton country. Male negro laborers begin working in the cotton fields in early January. They finish work early in July, when the cotton has grown high enough to make further cultivation impractical. When picking time comes, the work is done by women and children. But the men leave the cotton fields in July and go to sawmills, or perhaps up North for temporary jobs.

The whole economics of these sawmills is wrapped up in the fact that they can get this cheap negro labor for about six months a year. Owners of these mills think they would be ruined by the wages-and-hours bill. They are numerous, as the mills are small; hence they are important politically.

Which explains a good deal about the perturbation among the cotton state legislators. Especially as it adds on to the two existing problems for them—the North versus South differential and the broader problem of negro labor.

However, a vote *is* going to be forced, sooner or later. The bill will pass the House, pass the Senate, and go to conference. As it is there that the final draft of the legislation will be agreed upon and written, it is reassuring to those desiring a conservative outcome to consider the persons who will represent the House in that meeting.

The Senate we can ignore for the moment. The view of the Senate committee, as evidenced by the Black report, was far more conservative than anyone expected.

But how about this radically controlled House Committee?

House conferees are appointed by the Speaker. Almost invariably, however, the Speaker exercises little discretion. He just appoints members of the committee concerned in the strict order of their seniority—three of the majority and two of the minority party.

Speaker Bankhead himself is on the conservative side of this issue, so there would be no particular point in his upsetting precedent to help the conservative side. Which is not necessary, because the three top names on the seniority list of the Democratic membership of the House Labor Committee are Mary T. Norton of New Jersey, Robert Ramspeck of Georgia, and Glenn Griswold of Indiana. Each one of them is on the conservative side.

On the Republican side are Richard J. Welch of California and Fred A. Hartley, Jr., of New Jersey. Both conservative.

Hartley actually introduced a bill that would force incorporation of labor unions and hold them to financial responsibility.

Little Doubt about Outcome

With a group of senators who have already decided not to risk constitutional difficulties, but to make the measure really more for eliminating sweatshops and child labor, and improving wages-and-hours conditions in just a few industries (some whisper that textiles is the only real target among the larger industries), and with this group from the House writing the final bill, there is little doubt about the outcome.

If the House as a whole were radically inclined on this bill, it is just possible that the present prospect for a very conservative measure—something like the bill reported by Senator Black—might be too optimistic. But there is no such situation, especially with so many of the Southerners wanting to punch loopholes in the bill.

And it would indeed be an unusual spectacle for some of the radicals in the Senate to charge Senator Hugo Black with sponsoring something that did not go far enough in the interest of labor.

International News

PEACEFUL PICKETING at Alcoa, Tenn., where two days earlier two were killed and twenty were injured. The pickets are peaceful, to be sure, but there are 200 National Guardsmen on hand to guarantee the right to work to those who want to work. Should not the Wagner Act be amended to insure peaceful picketing as a matter of course?

Spot the Best by Test

Dual operations, properly set up, often effect time savings of 30 per cent. Boost your batting average to 40 per cent, or higher, by using the right tests

CHARLES A. DRAKE
Industrial Psychologist
Eagle Pencil Company, New York

IF AN ASSEMBLY job can be done with one hand, using the other hand or some mechanical aid for holding the work, it is generally believed that greater economy will result from simultaneous assembly of two units of the product, using both hands. Such a conclusion must be accepted with caution and then only after a tryout. Both the nature and extent of the assembly motions and the fact of wide individual differences in operators are factors that influence results.

Time-and-motion-study specialists have long contended that dual operations on assembly should effect, roughly, a 30 per cent saving in time per unit of product. They also concede that such savings may be materially reduced where the operation cycle is short. Both observations of jobs and experimental tests support their views when those under observation or test are "average" operators. But it is possible to utilize the fact of individual differences to select, by suitable tests, operators who can achieve a saving as high as 55 per cent.

In the process of making psychological job analyses as a basis for test specifications and the designs for tests for the jobs analyzed, it was observed that numerous dual operations were dual in name only. The operators were in fact alternating the hand motions that were supposed to be done simultaneously.

Later, when these operators were tested on the dual tests, it was found that many of them were inherently incapable of achieving dual coordination. Even more striking was the discovery that after intensive training under close supervision in a training department for two weeks, they were still incapable of attaining a performance that warranted the time and effort spent in training.

A Specialized Ability

It is now fairly clear that dual operation ability is as specialized, but not as scarce, as inspection ability. Test results indicate that not more than fifteen satisfactory dual operators are found among 100 applicants for employment, while only eight qualify for training for inspection. If dual operation and inspection ability are called for in the same person, the combination will be found in only three of the hundred.

Many operators of high potentiality for dual operation are to be found among old employees who have been doing non-dual work. There is no evidence that the trait is modified by non-use, since the experienced operators show the same distribution of test scores as the new applicants. Also, a good dual performer on one test is not necessarily, but tends to be, a good performer on any of the other dual tests.

The tests in question were a pinboard (described in the June issue), a controlled turning, and a left-right turning test. In each case the percentage saving was computed by dividing the time taken to do the test with the leading—usually the right—hand, into the difference between that time and the time taken to do the test by dual operation. That is, if the time taken to do the test by the right hand alone was 100 seconds and the time taken by dual operation was 60 seconds, the saving would be $(100 - 60) \div 100$ or 40 per cent.

The three tests used differed from each other in several important particulars. The pinboard involved the

The controlled turning test involves the insertion of slotted keys through holes in a vertical steel plate. This is one of the tests used to select operators of high potentiality for dual operations

Right-left turning test used to determine whether the girl has the makings of a good dual operator. She turns two long screws into a vertical plate, left with left hand, right with right

placing of 32 pins in each board, the cycle of operations on each pin consisting of five elements. The controlled turning test involved the insertion of twenty slotted keys through holes in a vertical steel plate. It had a seven-element cycle. The right-left turning test required that long screws be turned, right with the right hand, left with the left hand, through a vertical plate. Its cycle consisted of three elements.

In addition to the foregoing differences, it is worth noting that the pinboard required the manipulation of objects one-eighth inch in diameter, involving finger dexterity and whole arm motion. The controlled turning test used objects one-half inch in diameter, involving much finger and wrist motion, with two positionings for each unit. The right-left turning test could be performed with either finger or wrist motion predominating, the person tested choosing his own style, while the size of the object—one-fourth inch in diameter—was relatively unimportant.

Results of Three Tests

Results in terms of savings by dual operation on the three tests are shown in Table I. Comparison of the last three columns shows that savings on the pinboard and the right-left turning tests were approximately equal and averaged around 31 per cent, thus supporting the contentions of the time-and-motion-study specialists. But the average savings on the controlled turning test are about 11 per cent, with many cases showing negligible savings or actual losses.

This latter result is attributed to the two difficult positionings of the keys and the need for greater precision of movement in all the elements of the cycle, as well as the longer cycle itself.

The reliabilities of these three tests are all over .90. That is, successive applications of the tests to the same persons yield almost the same time scores, so that the results may be accepted with confidence in their stability. If the results of the tests can be related to performance on jobs requiring dual operation, their use is justified in preference to the old method of trial and error in selecting dual operators.

A Chance to Compare

The best data for comparative purposes came from the results of the daily records of performance in the training department. Table II shows the comparison in terms of per cent of "normal" time allowed for three of the dual operations on small-parts assembly.

This merely represents a comparison of those who "passed" the tests by scoring in the upper half of the distribution of scores with those who "failed" by scoring in the lower half. When the comparison is made between those recommended for dual operation and those rejected, the results (Table III) are more striking.

While the difference in average gains between the two groups is not

TABLE I

Savings by Dual Operation

Savings (per cent)	Tests Used		
	Pin Board	Controlled Turning	R-L Turning
51–55			2
46–50	1		9
41–45	18		16
36–40	49		16
31–35	72	2	19
26–30	72	10	14
21–25	38	12	15
16–20	17	15	7
11–15	5	22	9
6–10	1	25	8
1– 5	1	13	
–4– 0	1	13	2
–9– 5		4	
–14–10		2	1
–19–15			1
–24–20		2	1
Totals	275	120	120

marked, the comparison between the points at which they start and finish is startling. The recommended group starts its training above normal, and at a level that the non-recommended group cannot attain after two weeks of intensive training. Clearly, these results warrant the careful selection of dual operators with the aid of suitable tests.

A comparison of the nature of the work on the several dual jobs with the results of the tests indicates that the greatest handicap to increased savings through dual operation comes from difficulties in positioning the parts manipulated. When this positioning is difficult, the dual operation usually breaks down into two separate operations in which attention goes first to one and then the other of the two hand operations.

Mechanical Aids

When this occurs there is no gain over a one-hand operation in this element of the cycle, since one hand is at rest, or at least ineffective, while the other hand is working.

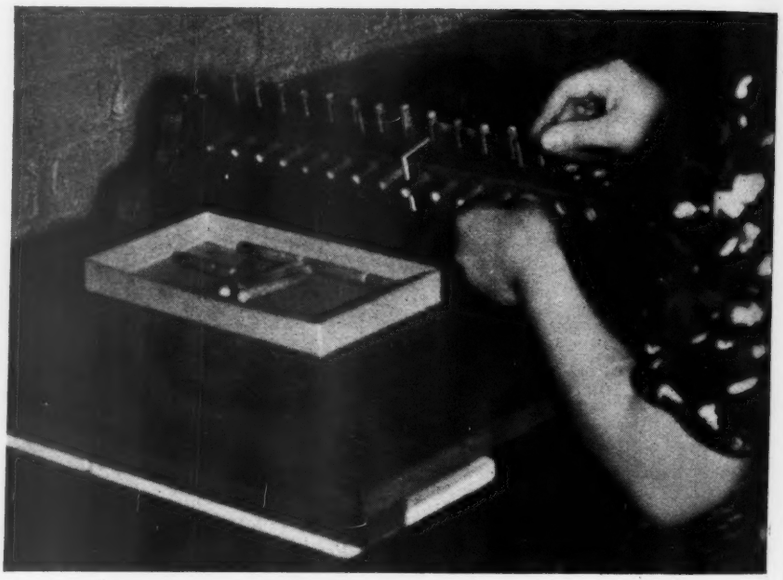
Experience points to the fact that certain mechanical aids may contribute largely to the efficiency of dual operations. Better arrangement of parts will cut down the distance transported by the hands and may facilitate the grasp of parts by the hands.

This is especially true where the parts can be presented in hoppers or otherwise arranged all in the same relative position, thus requiring a minimum of attention to the element of grasp or pick-up. Flared or funnel guides may frequently be used to aid positioning, so that delicate and exact finger adjustments are not required and strain on both attention and eyesight is minimized.

An additional complication appears in some dual operations through the necessity for operating a foot lever or treadle at some point in the cycle. Tests indicate that the ability to combine hand and foot coordinations shows as wide a range as does the ability to coordinate the two hands. Lack of this ability is known to be related to accident-proneness as well as to low economy in operation.

Where a job requires that such a foot motion be coordinated with the hand motions, the choice of a suitable operator should be made with the aid of a hand-foot coordination test. While excellence in dual coordination is usually associated with ability in hand-foot coordination, there are many exceptions, and the only safe and logical approach is to test the prospective operators.

If the dual job is properly set up, and operators are selected by suitably designed tests, it should be relatively easy to raise the average savings by dual operation to 40 per cent,



Close-up of a hand-foot coordination test in which operator inserts two kinds of pins in a horizontal bar. Bar is rotated by a pedal after each insertion

TABLE II

	Average Time at Start (per cent)	Average Time at End (Two Weeks) (per cent)	Average Gain (per cent)
By those who passed tests	80	97	17
By those who failed tests	76	91	15

TABLE III

	Average Time at Start (per cent)	Average Time at End (Two Weeks) (per cent)	Average Gain (per cent)
By those recommended	103	119	16
By those not recommended	79	93	14

or even higher. Certainly there exist among the applicants for factory jobs a sufficient number of highly gifted dual operators to fill all the jobs that can be satisfactorily set up for dual operation.

Random selection will lead to the attempt to get dual savings from operators not equipped by nature to effect such savings. Then the method will be blamed, or the mechanical fixtures will be blamed, whereas the real difficulty resides in the fact of an unlucky guess about the operator's innate ability.

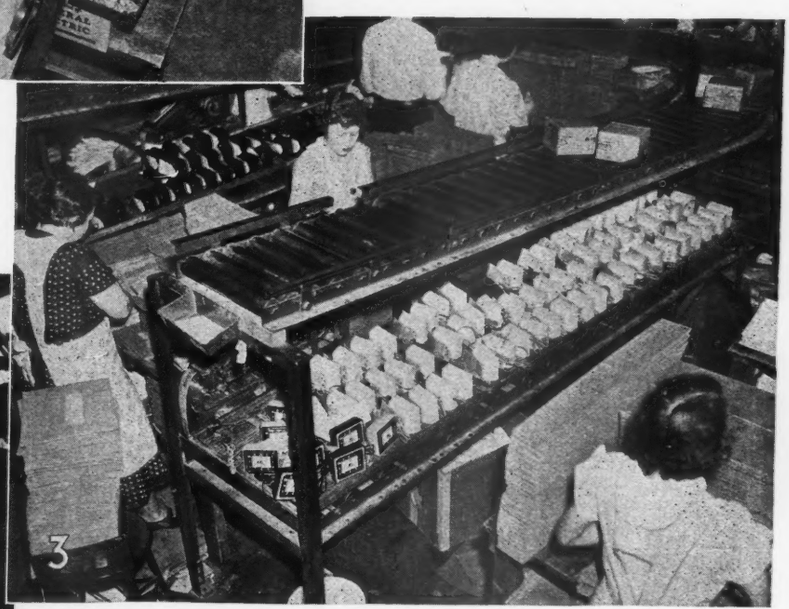
It has long been recognized that people differ in height, weight, color, intelligence, vision, etc. Now it is demonstrated, by the demands of industrial adjustment, that they differ likewise in ability in dual coordination, in hand-foot coordination, and in their ability to combine dual operation with foot coordination.

Made on the Move

More people pay less and less for useless handling, get more and more clock for their money

1 Kitchen clock assembly conveyors at Warren Telechron plant allow 26 seconds of work at each station. One clock comes off every 22 seconds. Colored squares set the production pace

2 Conveyorized assembly operations — four lines in all—turn out 5,000 clocks a day. Girls on this line assemble the rotor units that drive the clocks. This girl assembles gear train as units pass by on special tray conveyor



Packing, too, is completely conveyorized. Rollers bring the clocks in on pallets from the inspection department; three roller conveyors take them away after they have been packed to a belt which leads to the shipping room

4 The man with the stethoscope is an inspector who checks each clock motor for noise during a 15-hour run-in test. Even this job is, you might say, done on the move. These racks serve as carriers, also as actual test benches

No Grandstand Players Wanted

JOHN RICHELSEN
Personnel Director
Vanadium Corporation of America
Niagara Falls, N. Y.

THE MOST efficient worker may not, by a long shot, be the most valuable worker in his department. Loyalty is an essential factor of good workmanship.

Efficiency of group operations in industry is dependent on the spirit of loyalty to a common purpose. That common purpose is the success of all the members of the group, attained by the success of the company itself, of which they are parts. Lack of loyalty to one another and to the common purpose, especially among foremen in industrial plants, has been the cause of hundreds of business failures. And many a plant on the down grade toward bankruptcy has been saved by the surgical operation that eliminated disloyal employees.

Loyalty has no meaning beyond an empty and futile sentimentality unless it includes cooperation. Loyalty without cooperation is like faith without works, a dead and useless thing. If a man says, "Certainly I am loyal to my company," but has not the spirit of cooperation, his profession of loyalty is vain. A man who will not cooperate may deceive himself by thinking he is loyal to his company because he is a hard worker, when in point of fact he is the very opposite of loyal.

Menaces to Success

No man may be called loyal to group achievement, the success of a company, if his attention is riveted on himself alone. Grandstand players are not only a pest to their associates but also a menace to success.

A foreman who cannot cooperate with other foremen, or a furnace man who cannot cooperate with other furnace men in his crew, should be cut out of the herd even though otherwise a very efficient workman.

Many a professional baseball team has been cursed by having star performers who wouldn't deflate their swell-headedness and work for the team. Industrial success, like a baseball game, is won by teamwork. When the stars who will not cooperate are canned, the team wins more games. Every athletic manager knows that games are won by "assists" and sacrifice plays; the batter is told by the manager to bunt and is counted out with a zero after his name in the box score, but the man who was on first is advanced to second, and that may have been better for the team as a whole. Mediocre players, working together, make a better team for winning games than a better nine with one or two non-cooperative stars seeking only their own glory.

Confession of Inferiority

In industrial life the non-cooperative spirit displays itself in efforts to enhance individual importance by "showing up" rather than assisting other workers. I have seen a foreman sacrifice his company's interests in order to get another foreman into trouble, thinking to place himself, by contrast, in a more favorable light. It is a confession of inferiority, or a sense of doubt about one's own worth, that causes a man to belittle his equals or seek to bring his superiors down to his own level.

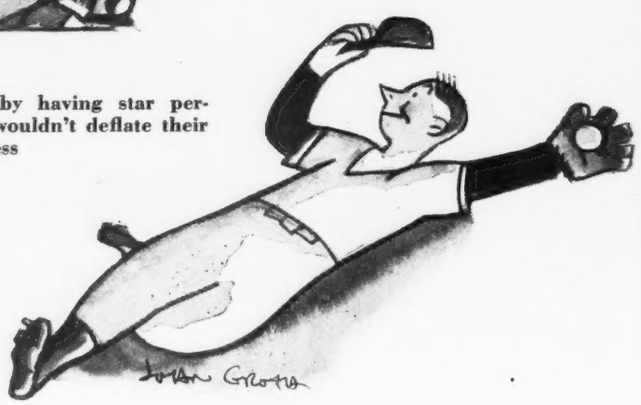
When a man can take pleasure in seeing someone else get ahead and prosper, he is on the right road to his own prosperity. When he is filled with bitterness over the advancement of others, he is digging a deep mental rut for himself from which it will be increasingly difficult to emerge.

No Ladies' Seminary

Life in an industrial plant is not the same as life in a ladies' seminary. There are differences. But certain facts about social life—the life of human beings in contact with human beings—remain constant. One of these is that true worth will be recognized without the necessity of making grandstand plays.

In industry, an intelligent management soon gages a man's inherent value. And there is higher workmanship value in average ability with the loyalty that is cooperation, than in marked personal ability without cooperation.

(*Second in a series of very short articles based on the "Reflections of a Personnel Director." The third will appear in August.*—ED.)



. . . cursed by having star performers who wouldn't deflate their swell-headedness

Packages Must Stand the Gaff

CARL C. SHIPMAN
Tire Engineer, Tire and Tube Division
B. F. Goodrich Company, Akron

Goodrich packaging is an excellent example of coordination between factory and sales departments. This is the first of two articles on what, in this packaging engineer's experience, should dictate the appearance and design of a package

PRODUCTION improvements and economies need not stop with manufacture. Substantial savings can usually be effected by giving concentrated attention to packaging the product after it is made.

Results will, of course, be in proportion to the size of the business and the extent to which packaging enters into selling. In a company as large as Goodrich, each major division has enough packaging to require the time of a packaging engineer, and to make his function a profitable activity of the business. In a smaller company, it is probable that proportionate results could be attained by giving one man the packaging responsibility as one of his duties, or by calling on the experience of individuals who have had a wide contact with this line of work.

Consider the problem of packaging an inner tube. In the first place the tube is not straight, nor can it be folded so that it becomes straight. It weighs a few pounds or perhaps a good many, depending upon whether it is for use on a small passenger car or on a large truck or bus. It must be packaged attractively so that it will stand out on the dealer's shelves. Yet it must also be packaged so simply that when the dealer takes it out of the container to show to a customer, he can put it back without any difficulty, just as neatly as it was packed before he opened it.

The carton must be adequate to deliver the tube in good condition all the way through the channels of distribution to the customer who will eventually put it on his car or truck. It must be as inexpensive as possible to comply with all the above requirements, and it must lend itself to economical packing at the factory.

There, in a few sentences, is essentially the packaging problem that confronts any manufacturer. Some of the conditions inevitably vary

Figure 1. Without forcing, the tube can be folded (left) to fit into a square carton, with the valve protected by the folds. The one-piece cartons are delivered to the packing line in compact, knocked-down shape

Figure 2. Although the folded tube (above) takes the shape of a truncated cone, the cubical carton is best because the dealer can easily stack it

with the product. For example, loaf sugar need not be packaged for the dealer to open and display, since everybody knows what it looks like. Most articles produced in mass volume are of shapes to package naturally, such as squares or cubes or cylinders. A great many plants turn out only parts that go to other manufacturers. They do not require the least care as to display since they are never on display. But, by and large, the packaging problem in its essentials is contained in the problem of our inner tube carton.

Because our tube is made in a curved mold, it is distinctly awkward to pack. To get it into anything like a conventional square or cube would require a good deal of forcing. Our idea is that the best condition in which to pack anything is as close as possible to the shape it naturally takes. A tube can be folded back first to a semicircle, then from the ends in broad folds until it reaches —without any forcing—a shape that might be roughly described as a truncated cone. It is not cylindrical, for it is bigger across the bottom than across the top. As for the valve, that can be put out of the way by folding it back into the interior of the folds, where it is well protected against damage.

Into the Carton

A tube so folded can be placed easily in a carton that approximates a cube, although it is a trifle higher than it is wide. The broad base of the folded tube goes at the top of the package, the narrower top of the folded tube goes at the top of the package. To be sure, the box is square and the tube is round. But the outward pressure of the rubber pretty much fills all the interior of the box, and makes a nice snug fit. Once it is closed, the package and the contents are practically a unit of integral construction.

An important point to consider in connection with the shape of a package is how it will stack on the dealer's shelf. Our company had a tube package a good many years ago that lasted for only one season. It was an excellent package in every respect except one — although it fitted the shape of the folded tube because it was itself a truncated pyramid, it simply would not stack well on the dealer's shelf.

Our present tube carton is made of the weight of chipboard that experience and testing have shown necessary for the job. It is in one piece, and has one glued joint. Before setting up at the packing line, it folds down perfectly flat. It is creased for folding and has very little cutting to the closing mechanism. The result is a closure easy to accomplish and free from weak spots.

Easy to Stack

The box needs no seal other than its own folded top closure. When it reaches the dealer, it stacks handily on his shelf—it is as easy to stack as a well-made child's block. When he has to take out the tube to show it to a customer, the box opens easily, and the top is right there, an integral part of the box. If he now needs to replace the tube in the box, he folds it in the easiest, most natural way imaginable—just as it was done by the packer at the factory. The tube goes back easily into the box; how it goes is obvious at a glance. Then he closes the box with no fumblings or mistakes. And back it goes on the shelf, just as attractive and neat, and just as protective as ever.

We are proud of that tube carton because we think it is by far the best container yet devised for an inner tube—and it costs less than any other type of package we have ever figured on. It performs admirably every function that a good package should perform, from low original cost and low cost of packing labor at the factory, on through successful delivery to the consumer, in as good condition as when it left the factory. No matter if it has been unpacked and repacked a dozen times, it is as good as ever. And, of course, it is good display material —a subject that may be considered primarily a worry of the sales or advertising department, but nevertheless a point deserving of the best thought of the man who designs the package as a container in transit to the consumer.

Seven Components

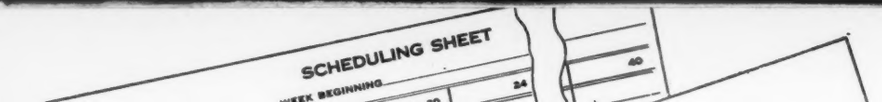
We divide every packaging problem into seven basic components:

1. Shape
2. Size
3. Weight
4. Packaging materials
5. Manufacturing economies
6. Safe delivery
7. Display and advertising value

These factors are listed exactly in the order in which we consider them when we design a new package or set out to improve our handling of a current product. They will be discussed in a succeeding article.

It is our belief that an opportunity exists in most manufacturing plants to cut costs and increase sales by improving packages. Moreover, many a manufacturer could obtain these benefits for a cost in time and effort which would be only a small fraction of the net yield.

Figure 3. An important thing to remember about packages for resale — the dealer must be able to repack readily after showing the wares



Responsibility for the maintenance of all equipment and buildings at this plant is vested in a department of 60 people. How the maintenance organization is set up and run is described in this article on

Managed Maintenance

JOHN I. THOMPSON
Assistant Plant Engineer
Bristol-Myers Company, Hillside, N. J.

ORGANIZATION of a maintenance department that will discharge its functions properly and at a minimum cost presents to management a nice problem that has many ramifications. It is a problem we have been working on for many years. Out of our study and experience has come a maintenance organization which at present contains 60 persons. It is responsible for the care of all plant and equipment.

Here's the Job

Our plant is located on a plot approximately 1,350 ft. long and 180 ft. wide. Structures occupied by our company include one six-story-and-penthouse building; two three-story and one two-story connecting building of reinforced concrete, flat-slab, construction; a power house and a general utility building of reinforced-concrete beam construction; two monitor-top, concrete-column, brick-curtain buildings, one of two stories, one three; a brick, steel-trussed, wood-roof shop and store building; a wooden warehouse.

In addition, we rent to other concerns one brick-and-steel, mill-construction, monitor-type building; a two-story, brick-curtain, concrete-column building; and a precast concrete, steel-framed, flat-roofed, one-story building. These tenants are supplied process steam, some air conditioning, and certain other minor services, and we provide the usual landlord maintenance service. The floor area under roof totals a little less than 300,000 sq.ft.

Altogether there are about 30,000 sq.ft. of lawn, a 30,000-sq.ft. parking area for employees, ample driveways, various truck-loading points accommodating fourteen trucks, and 650 ft. of car-floor-level platform along the railroad siding. A service tunnel connects all buildings with the power house.

Steam for processing and power generation is obtained from oil-fired boilers of 610-hp. rated capacity. Two engine-driven, three-phase, 440-volt alternators carry the 300-kw. electrical load. About 460 motors varying from fractional to 40-hp. rating are connected to the lines. There is a total of seven elevators in four buildings.

The maintenance and engineering organization is headed by the chief engineer. His staff consists of a master mechanic, chief electrician, the senior operating engineer, and an assistant, all with equal responsibility. In the office are a secretary and a stenographer-clerk who handle clerical work, and a draftsman.

Much of our equipment is automatic machinery, and because of its specialized nature a separate staff consisting of shop foremen, floor foremen, and a draftsman are attached to the packaging department and function principally in direct collaboration with the production manager. In addition to the personnel mentioned above, there are 49 other employees representing several trades, the power house employees, four porters, two watchmen, and a storekeeper.

When a department head wants to have certain work done, a Maintenance Job Requisition (Figure 1) is filled out out and sent to the chief engineer's office. Here it is OK'd and given a serial and account number.

A meeting of the chief engineer's staff is held once a week. A list of all job requests is presented at this meeting and, with previous lists, it constitutes the basis of a planning session. A simple Scheduling Sheet (Figure 2) is used by the foremen at these meetings to plan their work. As each job is scheduled, the foreman responsible for it blocks out the estimated hours after the name of the man he intends using on it. In this way the foremen can readily tell when their man-power is absorbed, or *vice versa*.

If material which will take a while to obtain is needed for a job, it will be decided at the meeting to order such material, and the job will again come up after its receipt. When drawings are deemed necessary the job will likewise wait until these have been made. This method of handling jobs insures planned work, and not much more or less is planned than available man-power warrants.

Rush jobs are, of course, handled in whatever way seems best under the circumstances.

Next, a Weekly Schedule

The next step is the compilation of a weekly schedule which is placed on a blackboard. The storekeeper posts this schedule from the listing made by the various foremen and consolidated by the assistant engineer. This board is mounted with other bulletin boards and a mail box at the entrance to the stockroom and maintenance department offices. The left-hand column contains the job numbers, the body a short description of the jobs, and the right-hand column the name of the mechanic or the mechanics

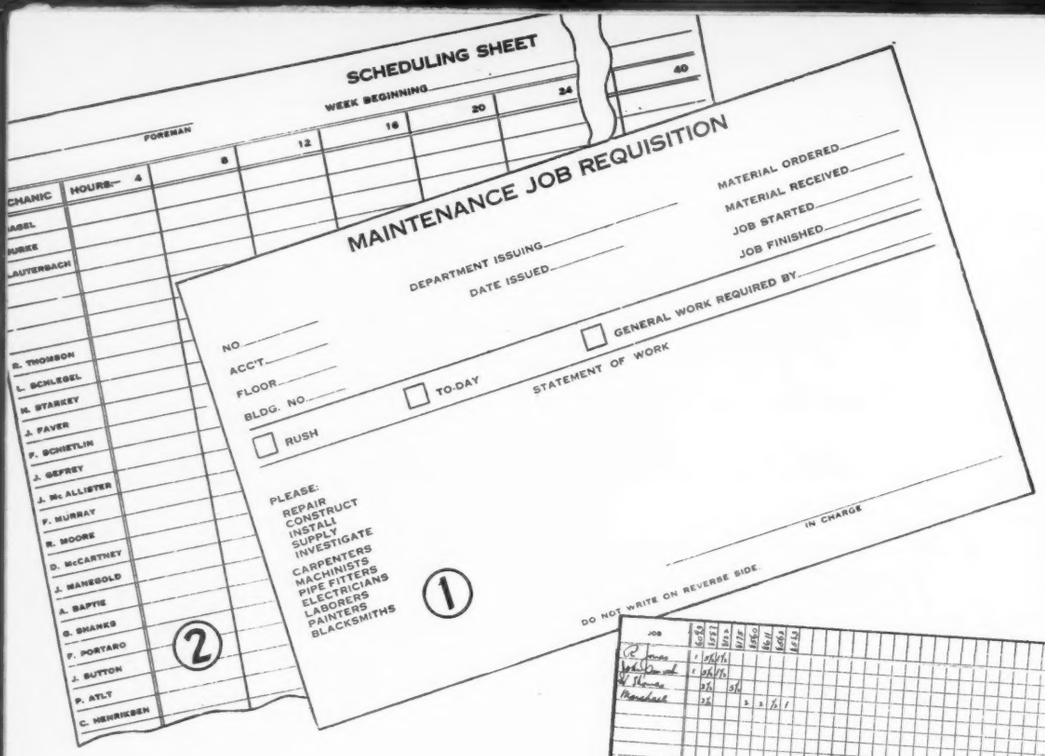


Figure 1. When maintenance work is required by some department, the foreman fills out one of these requisitions and forwards it to the chief engineer

Figure 2. Scheduling sheet used by maintenance department foremen in planning their work. The estimated number of hours required for a job is blocked out on the horizontal line containing the name of the mechanic selected to do the work

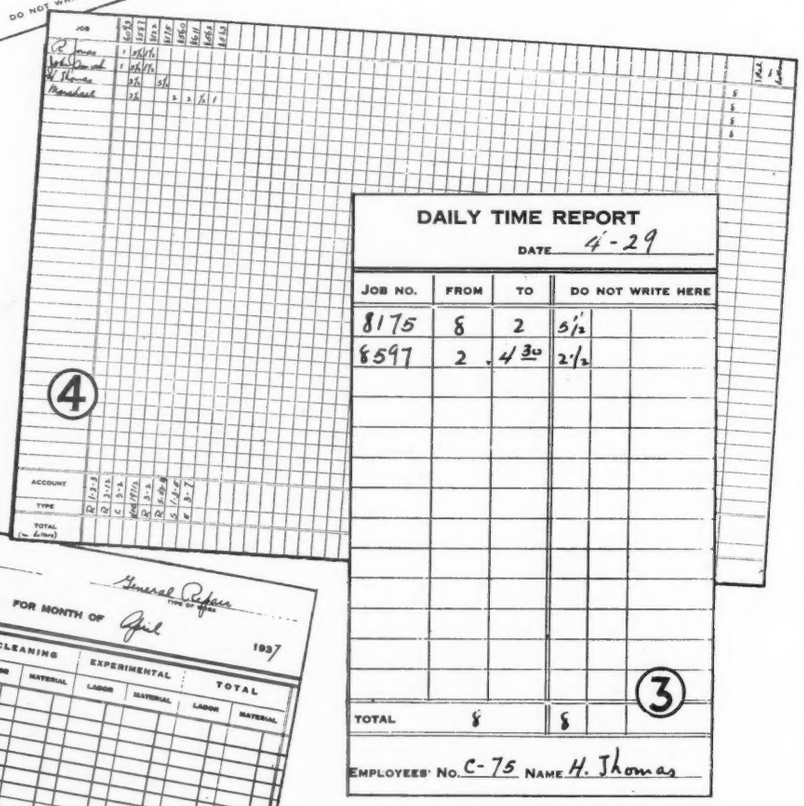


Figure 4. Daily time reports are posted on this sheet

Figure 3. Each mechanic makes a daily report of his work on a 3x5-in. card

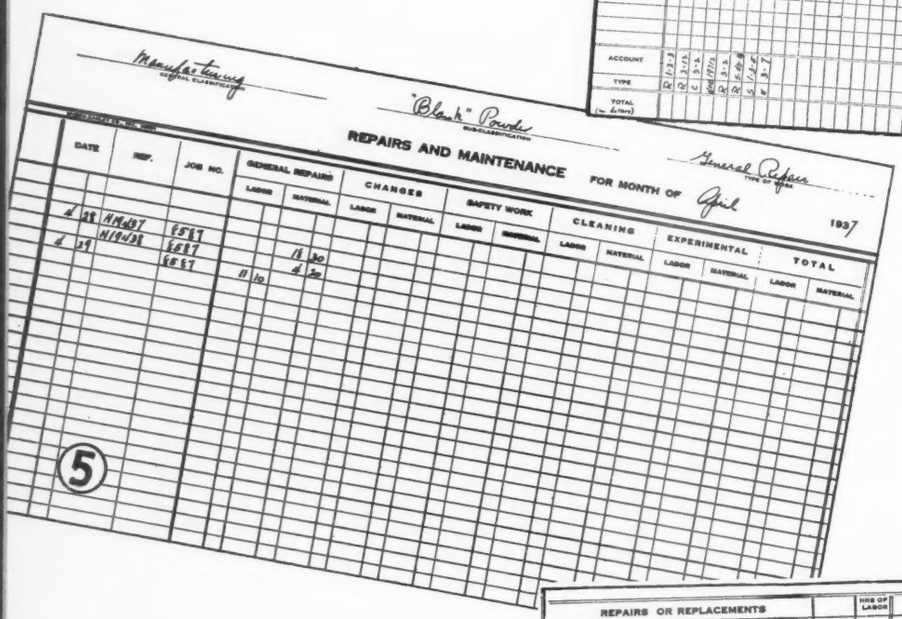
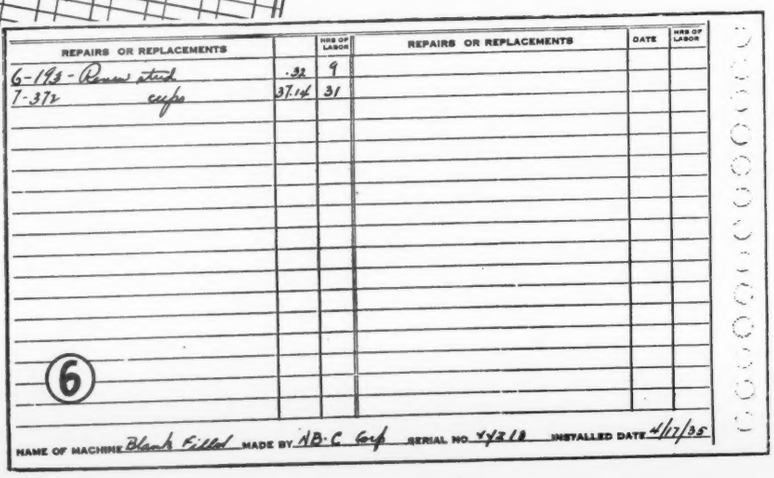


Figure 5. Labor and material charges for each account are properly distributed on its ledger sheet

Figure 6. A record of the performance of each automatic machine is kept on a form like this



to whom the job has been assigned.

This board serves two purposes: (1) It assists the mechanic in making out his Daily Time Report; (2) it gives him some information about the work ahead of him. Also, there is kept posted on the bulletin board the list of purely repetitive jobs, inspections, and the like, which have the same basic number each month, the index number only being changed. This permanent schedule insures that they will get attention, without a tickler system.

The Daily Time Report (Figure 3) is a substantial pocket-size card on which the mechanic lists the numbers of the jobs he works on, with the time of starting and finishing them. His card may, for example, read, 4135: 8.00-10.30; 7215: 10.30-1.15; 621: 1.15-4.30. These job numbers are kept in monthly series, and when the number reaches 10,000, they go back to zero again. Using monthly steps of 500 it takes 20 months to repeat a number; so there is no danger of current repetition, and the whole number is not so large as to be unwieldy.

From the Daily Time Reports the maintenance department clerk obtains the hours worked for entry on the daily Time Sheet (Figure 4). This is indexed vertically with the mechanics' names and horizontally with the job numbers on the top and the account numbers on the bottom. The monetary wage per man is carried at the right-hand column and per job at the bottom. The former is used for payroll and the latter in job-cost accounting.

In All, 250 Accounts

These job costs are entered on the reverse side of the corresponding Maintenance Job Requisitions which, when completed, are filed permanently under their account numbers. There are about 250 accounts in all, based on products, buildings, and so on, thus providing an easy reference to any job.

One page is also kept for each account in a ledger. This page (Figure 5) is arranged to distribute all labor and material charges under the separate headings of changes, repairs, cleaning, and safety in each separate division. Aside from its use as an index for job reference, the value of the ledger lies chiefly in presenting a picture of where expense lies heaviest.

A card index (Figure 6) is used for classifying labor expense against machines in the packaging department, in which there are about 150 automatic machines. There is a card for each machine and when the labor is taken from the time card it is transferred, with the job number for reference, to the proper machine card. The production manager can then get a complete picture of machine performance by running through these 150 cards.

For example, a machine may start going "sour," but the maintenance required may increase so gradually that the mechanics think nothing of it. The comparative figures, however, tell immediately that a certain filling machine, say, has cost three times as much in 1936 as it did in 1934 or 1935.

This card index has been of great value in the selection of replacement equipment, too. And it takes only about 30 min. a day.

There are, of course, certain repetitive jobs, such as regular inspections. One man is detailed to examine and lubricate all motors twice a month. Elevator equipment is inspected and lubricated weekly, one man being detailed to this work. Once a month he examines and lubricates all speed reducers. He also examines all roller or ball bearings, at certain points, on a semi-monthly inspection schedule.

Inspection of safety valves, gages, and the like is made four times annually, and in some applications as often as considered necessary.

One man is detailed to constant duty with a vacuum cleaner; he starts at one point and continues through the plant until every inch of floor area, wall surface, and piping has been cleaned, and then begins all over again.

Inspection of plumbing is made weekly. During the summer, at a specified time, all valves in the heating system are repacked and given whatever attention they need.

Painting is not done according to any particular schedule, but rather as required. It is usually found necessary to paint the exterior masonry every other year, using a white portland cement. The tank for the automatic water sprinklers is painted every third year. The interior of the plant has been completely painted with aluminum at least once, and whenever an area becomes dirty or scarred it is repainted. Window washing is done monthly under contract.

There are a number of individual machines which it is necessary to inspect and repair regularly. This work is done according to schedule. The principal method of insuring performance of these regular inspections is to treat them as specific assignments to individuals. Of course, the men have a constant reminder in the so-called repetitive job schedule, referred to previously. A check is available from the requisitions covering each of these jobs.

These repetitive jobs, of which there are about 75, always carry the same base number. Therefore, at the first of each month these requisitions are revived and the index numbers changed. That is, job No. 44 becomes job No. 544 next month, No. 1044 the following month, and so on. Each time a new requisition is made out to cover it. Since this requisition has to pass through the usual channels to the file it is automatically checked for labor, which represents the fulfillment of the work. Any irregularity is reported to the proper authority.

Peaks and Valleys

A valuable byproduct of our system, which shows quite clearly the expected demands upon the maintenance department, is more equitable distribution of labor. The department is able to handle with men familiar with the intimate workings of the plant a great deal of work which might otherwise have been contracted out. All peaks of specialized work are thus taken care of, and planning fills in the valleys with ordinary repairs.

It is remarkable how many things can be done by the plant maintenance force that will later repay the management by obviating the necessity of a major contract job. Almost every type of building repair can be made by a good millwright, if he is given a little special supervision. Likewise, most of the ordinary repair work on the equipment of a specialized industrial plant is best done not by the skilled, production-type mechanic but by men with some common sense and a thorough acquaintance with that industry's equipment, who are given considerable special supervision.

There is usually enough structural repair work, pipe renewal, cleaning and such, that need not be done at a certain time, to "fill in," thereby eliminating contract work or a fluctuating plant force. This does not mean that a lot of supervision should be spent in showing a painter how to make an adjustment in machine alignment, but rather that the capabilities of the worker skilled in mechanical lines can profitably be broadened to cover the closely adjoining fields of work.

Industry Lighting Series

2. Shoes

Second of several studies by Illuminating Engineering Society. First—in the printing industry—appeared in June. Third—in the textile field—is scheduled for October

DEAN WARREN
Engineering Publications
Nela Park Engineering Department
General Electric Co., Cleveland

THE STUDY just completed in this industry was undertaken to arrive at a common understanding of the basic problems of the industry, the seeing tasks involved, and the quality and quantity of light necessary, rather than to arrive at a specific determination of various types of equipment that should be used for each seeing task. Each step of the manufacturing process has been carefully examined and the visibility meter used to appraise the seeing task.

Upper Department

This department is divided into six sections embracing such operations as sorting, trimming, cutting, staying, marking, skiving, and assembling.

The sorting department requires higher levels of illumination than any other area in the plant in order that flaws, scars, and cracks may be quickly and accurately seen. Both light and dark materials are sorted here, and study indicated that at least 20 foot-candles would be necessary for light materials and 40 foot-candles for dark materials.

A symmetrical overhead system of lighting is recommended, and where benches are placed parallel to the windows the lighting units must be so located as to avoid shadows cast by the operators. In general the units should be placed on a line with the edge of the bench. The units should be either equipped with daylight lamps or with the commercial type of color-correcting globe.

All other operations performed in this department can be satisfactorily lighted by means of an overhead lighting system, producing approximately 20 foot-candles for light materials and 40 foot-candles for dark materials, except in the skiving department where 20 foot-candles are adequate for either light or dark material. The different levels of illumination can be provided without difficulty because of the practice throughout the plant of segregating the light from the dark materials.

Stitching Room

This department, which embraces such activities as lining, tipping, closing, staying, boxing, top stitching, buttonholing, stamping, and toe closing, presents some severe seeing problems. Study of these tasks has resulted in the following recommendations:

1. A general illumination of well-diffused light of 10-foot-candles intensity.

2. Supplementary lighting at the machine secured by fastening to the table, at each machine, near the needle point, on the right-hand side of the operator, an adjustable arm carrying a deep bowl reflector of opaque material, equipped with a lamp to provide 60 to 75 foot-candles on the work, depending on the color of the goods. Figure 2 shows the location of the auxiliary lighting equipment in exact relation to the sewing and stitching machine.

The reason for locating the equipment in this position is that the reflected light from the polished working surfaces of the machine will be cast over the right shoulder of the operator between him and the operator on his right. This position also provides a secondary shadow across the leather just

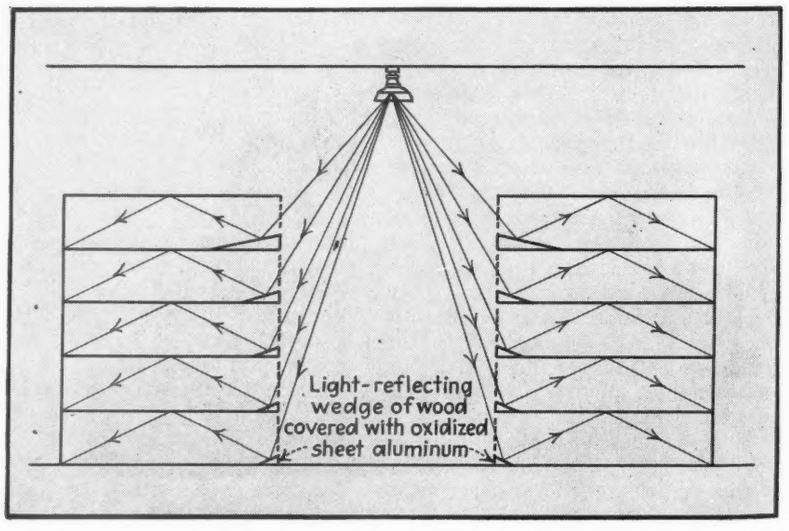


Figure 1. Storage bins for lasts are lighted by using light-reflecting wedges. Bins are aluminum painted inside to insure good reflection

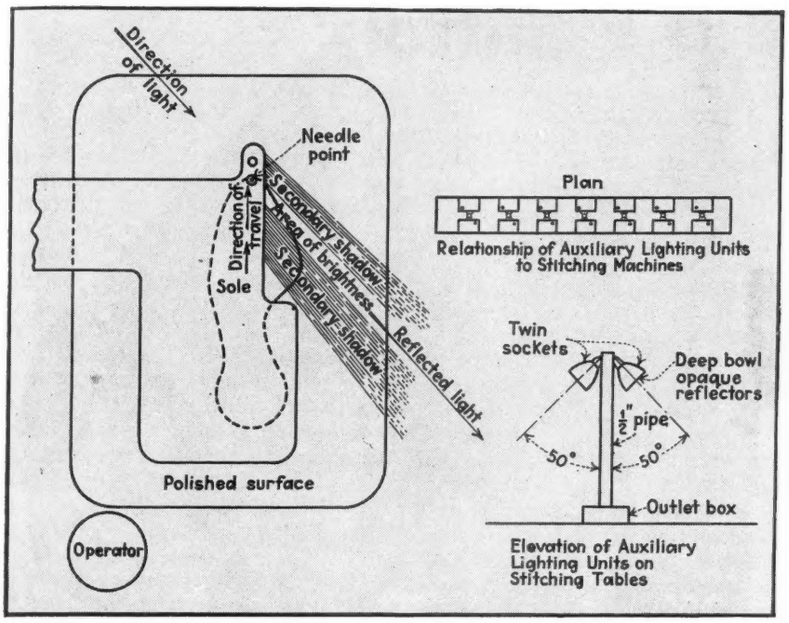


Figure 2. This sketch shows how a typical stitching machine is properly lighted

ahead of the needle point, and this shadow helps to accentuate seeing conditions at the point of work, due to the increase in contrast ratio.

Making Department

The operations performed in this department are vamping, welt-bottoming, heeling, turning, pegging.

Because this department is generally located in the section of the factory where the greatest amount of daylight is obtainable, local lighting was suggested because of the prevalence of overhead parts and machinery.

In the majority of plants the machines are symmetrically arranged, thereby permitting a symmetrical system of localized lighting. In this department, as in some of the others described, a minimum level of 20 foot-candles for light material and 40 foot-candles for dark material is recommended.

Finishing Room

The next step in the shoe manufacturing operation is that of finishing. Here the shoes are placed on treeing machines in order that wrinkles may be ironed out and from there are sent to the final inspection division.

General overhead lighting of the order of 20 to 40 foot-candles depending on the color of the shoe is entirely satisfactory.

Sole Leather Department

In the leather storage and grading leather departments the prime requisite is a good level of uniform general overhead illumination, on the order of 10 foot-candles. In the case of the grading department it is recommended that partial daylight correction be had by using either daylight lamps or partial daylight correcting enclosing globes.

Soles and insoles are stamped out by a beam dinker. This machine consists of a heavy cast-iron frame with a large beam that moves up and down exerting heavy pressure on a die, which in turn cuts the sole leather.

There is some hazard in connection with operating this machine, and for that reason it is essential that adequate illumination be provided beneath the beam and directed toward the die. General localized lighting of approximately 20 foot-candles with the units placed at the rear of the machine or the operator's side of the machine is required. Because some of the machines are of the obsolete type having a wider beam, it is necessary to provide auxiliary localized lighting in addition to the general localized type for satisfactory lighting.

The supplementary lighting units should be placed at the nearest physical support to the beam dinker and mounted about 9 ft. above the floor, and so directed that the machine operator will not be in his own shadow at any time.

Last Storage

A novel solution to a unique lighting problem was evolved in this department. The storage section utilizes a number of bins with 3-ft. aisles. The front section of the bins may be adequately illuminated by using an industrial reflector with an asymmetric type of distribution and mounting it directly above the center line of the aisle, as illustrated in Figure 1 on the opposite page.

With an overhead lighting system, however, the back of the bin would be in comparative darkness. This unsatisfactory condition was overcome by placing luminous covered wedges across the base of each bin at the front, and fastening them with carriage bolts to the face of the bin. The interior of the bin was painted with two coats of aluminum paint so that when the light strikes the wedges it is reflected to the walls and ceilings of each bin and the material stored therein is easily seen. This system increases the level of illumination in the bin interior by as much as 50 per cent.

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Jobs and Payrolls Still Going Up

SINCE May, 1936, payrolls in the manufacturing industries have risen 37.9 per cent, are now 2.4 per cent above the average in 1929, according to the National Industrial Conference Board's monthly survey.

Average hourly earnings are now 18.3 per cent above the 1929 level. Average weekly earnings rose 16.3 per cent since last May, are now only 0.5 per cent below the 1929 average, although the length of the average work week has declined 15.9 per cent.

Real weekly earnings, representing actual earnings adjusted to changes in the cost of living, were 12.1 per cent higher in May, 1937, than in 1929, and 9.9 per cent higher than last year.

The number of wage earners reached a level 18.5 per cent higher than a year ago, and 3 per cent above the 1929 average.

Applying Motor Controls

Service conditions as well as electrical characteristics affect choice of the proper controls and the kind of inclosure needed

G. O. WILMS
Chief Engineer, Allen-Bradley Company
Milwaukee

LAST MONTH some of the factors were considered that must be taken into account when selecting the kind of motor control best suited electrically to the conditions.

In many instances motor starters require a definite sequence of operation, or a given time interval between operations. When this procedure proves too difficult for the operator to understand or remember, or if it is too irksome, interlocking relays that automatically provide proper operation must be used to prevent damage to the machine.

Wherever possible the control should be so arranged that if it fails, it fails safely. Thus, by installing over-travel limit switches, parallel control contacts, or relays, two units will have to fail before damage can be done. It always pays to be careful in selecting pilot controls, because they are largely responsible for the performance of the equipment. Cost certainly should not be the guiding factor in their selection.

Keep Dust and Vapor Out

Starter mechanisms must, of course, be protected from dirt and other harmful agencies. Hence various inclosures have been developed to meet the widely varying conditions encountered in industry.

The type of inclosure to select is the one that is most economical (not necessarily the cheapest) and will provide adequate protection to the motor starter, the worker, and the surrounding equipment. Most manufacturers offer the following standard types of starter inclosures: General purpose, water-tight, dust-tight, explosion-proof, and explosion-corrosion-proof. These inclosures will cover practically every condition.

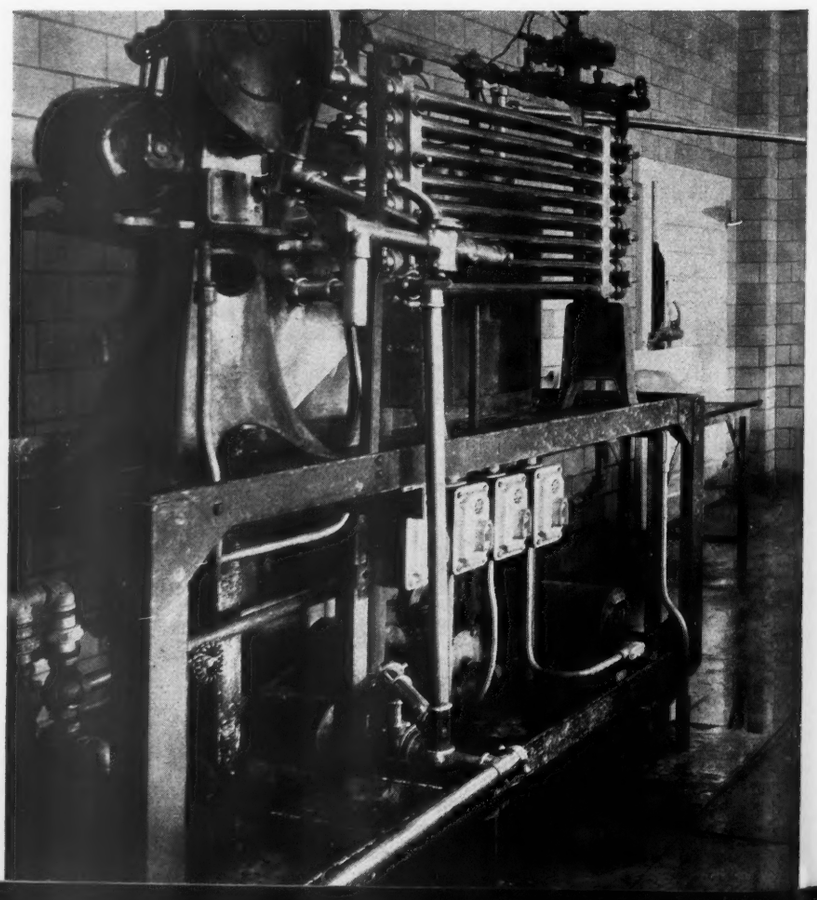
When a starter is likely to be splashed by liquid, or where there are fine particles of water in the surrounding atmosphere, a water-tight inclosure should be specified to prevent rusting, electrical leakage, and possible breakdown of the insulation. These starters usually have a cadmium-plated, cast-iron inclosure with a rubber gasket seal between cover and body. They are standard equipment in dairies and packing plants where equipment is washed down with a hose. Paper mills, rayon mills, and similar processing plants have also found that it pays to use water-tight equipment.

Standard sheet-iron inclosures are usually considered sufficiently dust-tight to protect the starter from the dust ordinarily encountered. However, if the dust contains metal, the story is different, since it may not take much to cause insulation breakdowns. In dry grinding operations, where metal dust is in the air, dust-tight inclosures should be used. Because metal dust may be carried from a distance, this precaution should be taken even though the equipment is not near the grinders. Where dust is combustible, as in flour mills and grain elevators, it may form a dangerous explosion hazard, and a cast-iron, machine-flanged-type, dust-tight starter, that has Underwriters' approval, must be specified.

When Explosive Gases Are Present

The Underwriters also specify that an approved explosion-proof starter be used wherever an explosive vapor or gas is present in the atmosphere. Inclosures of this type are not air-tight, but are constructed with wide, machined-surface flanges, so that if the contact arc should cause an explosion inside the starter, the flame will be confined and cannot escape to the outside and cause a general explosion. The inclosure is usually constructed of heavy cast iron so that it will withstand the internal force of the explosion.

In the chemical industries, sew-



age plants, and other places where corrosive fumes are present, the only protection against rapid deterioration is to immerse the control equipment in oil. It should be kept in mind, however, that contacts under oil have a reduced life—the wear increasing as the arc "cracks" the oil and forms carbon. Unless the oil is changed frequently this reduced contact life must be expected.

Overload Protection for the Motor

To protect motors against sustained overloads that are not great enough to blow the fuses, but which will damage the motor if they continue, overload relays are provided on most starters. These relays are not designed to take the place of fuses, and cannot do so, because they do not trip rapidly enough to protect against short circuits. Only a fuse or a circuit breaker can give this protection.

The maximum motor-starter rating may be greater than the motor rating, but the heating elements for the overload relays must be selected to fit the motor. When this is done the relays will trip only when a locked rotor or sustained overload endangers the motor. On the other hand, the motor will always be adequately protected.

In selecting the proper heater element the temperature of the air that surrounds the motor and the control has to be considered. If the ambient temperatures of both motor and control are the same, the element should be selected for this temperature. If the motor is in a hotter location than the control, a lower rated element must be chosen. On the other hand, if the starter has a higher ambient temperature, the heater-element rating can safely be higher and still provide full motor protection.

For intermittent loads it may be necessary to determine the correct heater element by test. Under these conditions the overloads may trip, but the motor, which has a greater thermal capacity, is not overheated. Therefore, a larger element can safely be used and will prevent unnecessary tripping of the control. On machine tools where it is difficult to determine the duty cycle, or where the duty cycle changes with every different job performed, it may be found that the only way to protect the motor is to use the motor heat itself to operate an overload trip. The only function for the overload relays on the starters would then be to protect against a locked rotor and single-phasing.

Most overload relays are of the thermal type, which must cool for a short time before resetting is attempted. When the time required for cooling leads to expensive interruptions of production, time-delay magnetic relays should either replace the thermal relays or be used with them. Such magnetic relays can function only as a safety valve, and will not protect the motor from load peaks of short duration which do not last long enough to trip them, but which may finally overload the motor. However, these magnetic relays can be reset immediately after tripping, and since the motor was cleared before it overheated, it can be started without delay.

Quick Tripping, Magnetic Relays

For woodworking machinery, where momentary high current peaks will occur as the cutters strike hard spots, magnetic relays are best since their quick tripping prevents damage to the motor and it can be restarted immediately after the machine has been cleared. The same thing holds true with automatic machinery, conveyors, and equipment that is likely to jam. It should be kept in mind, however, that a magnetic relay cannot always prevent damage to a machine when it is brought to a sudden stop, because the inertia of the gears, pulleys, and motor are back of it. In some instances mechanical protection must be provided.

Here a word of warning may be in order. If an overload relay is constantly tripping out, check the size of the element, but do not insert a thermal element of higher capacity before making a thorough investigation. Putting in a larger thermal element is like putting a penny in a fuse block because the fuse keeps blowing. There will be fewer shutdowns, but the motor will not be protected. Obviously, the proper procedure is to find the trouble, usually an overloaded motor, and correct it.

Line-voltage conditions in the plant are very important in motor-starter operation. In some plants voltage regulation is poor—every time an additional machine goes on the line, the voltage drops. If the voltage is too low, the contactors may not pull in completely, causing burning and possible welding of the contacts and, with a.c. equipment, overheating of the operating coil.

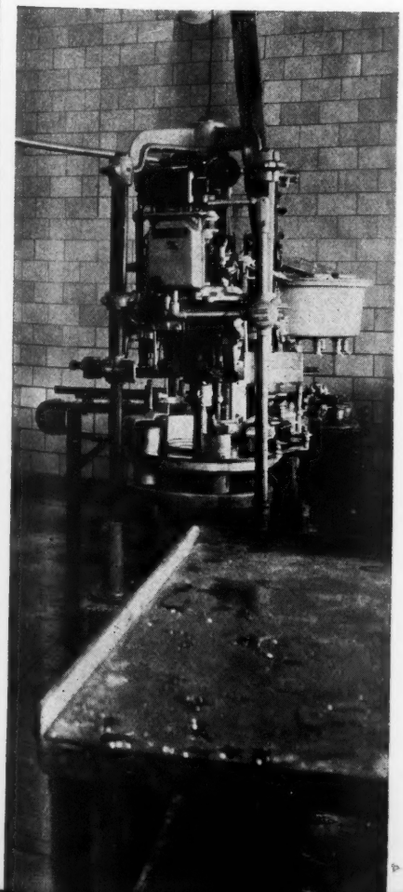
When Voltage Conditions Are Bad

Furthermore, motor starters may drop out if the voltage falls too low, thereby opening a motor circuit and shutting down the machine. Where line-voltage conditions are likely to be bad, a starter must be selected that has an extra low pick-up and drop-out voltage. On the other hand, excessively high voltages may overheat the coil, burn the insulation, and short circuit the turns. Special coils should be provided, therefore, for operation on voltages that vary from standard.

Where the starter is to be used in automatically controlling the operating cycle of high-speed machines, the speed of opening and closing should always be constant. Electrically controlled machine tools are especially critical. A change in the operating speed of a small relay, limit switch, or motor starter, may mean the difference between good operation and serious trouble. Speedy operation is desirable, of course, but consistency is much more important. Even though a motor starter operates with comparative slowness, the machine can be designed for this speed. However, if the machine designer cannot tell at what point the motor starter will open or close, it is practically impossible for him to design an efficient machine for high-speed operation.

There are a number of design features that insure easy installation

(*Continued on page* 154)



Dairies require starters with water-tight inclosures to prevent rusting, electrical leakage, and possible breakdown of the insulation

It's Easy to Apply Electric Heat

But to get all the advantages it offers, and insure long life of the heating element, there are certain precautions that must be observed

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WHEN ADAPTING production machines or other equipment for electric heat, consideration must first of all be given to the ultimate production requirements. The only way to increase the input of heat is to add additional heaters, or put in larger ones. Oftentimes it is not possible to do this unless provision was made in the design.

On the other hand, it is not wise to go to extremes and put so much heat in the machine that it cannot be taken away. If heat is not taken away from a heating element sufficiently fast to allow it to operate at a safe temperature, it will in time destroy itself by reaching the melting point. This action takes place without any increase in current, which would actuate an overload protective device.

Watch the Voltage

Such trouble can best be eliminated by selecting heaters with the lowest possible rating in watts per square inch of heating-element surface. Certain limitations will be discussed later. Under identical conditions, the heating element with the lowest rating in watts per square inch of active heater surface will last longest and usually give the best results. Electric heaters are, as a rule, considered 100 per cent efficient, since all the losses go into heat.

Heat generated in an element is the product of the square of the current and the resistance of the element. It is commonly expressed by the term I^2R, or as $E^2 \div R$. The heat varies therefore as the square of the voltage. Most electrical machines are designed to operate with a 10 per cent increase in voltage, and for this reason it is sometimes assumed that heating elements will stand the same increase in voltage. Actually this is a 21 per cent increase in load or wattage. Most standard heating elements are designed for a maximum of 5 per cent over-voltage, giving approximately 10 per cent overload in wattage.

Voltage regulation should be carefully considered, because the difference between the voltage when all machines are operating and at night when only a few machines are running, may represent a 20 per cent variation. With a 20 per cent increase in voltage, heating elements will be heavily overloaded. This is probably the reason for the occasional complaint that on one machine in one part of a plant the elements have lasted for years, whereas on identical machines in another place the elements have to be replaced every few months.

Since the wattage of an element varies as the square of the voltage, the amount of heat can very easily be regulated by varying the voltage externally.

On exacting applications where it is necessary to maintain a very even distribution as well as close temperature control, the ideal scheme is to vary the voltage by means of transformer taps, or otherwise, using a thermostat. If this method is too expensive, it is often possible to reduce the input by changing the heater connections. Circuits using an ordinary three-heat snap switch are well known, which give full, half, and one-quarter heat. There is also the possibility of getting other variations by means of a simple two- or three-pole, double-throw switch, as Figure 1 shows.

Applications on which heaters are most commonly used in industrial work may be classified as:

1. Liquid heating.
2. Heating of solids.
3. Air heating or oven heating.

It is commonly felt that direct immersion is the most efficient method of heating any liquid, because the heat is then applied directly to the material. In some cases, however, the shape of the container or the nature of the liquid makes it necessary to use external heaters.

If It Can't Be Immersed

If for any reason the heaters must not be immersed directly in the liquid, the double-tank system shown in Figure 2 may be used.

When heating water, particularly if it contains much lime, the rating of the heater should be carefully

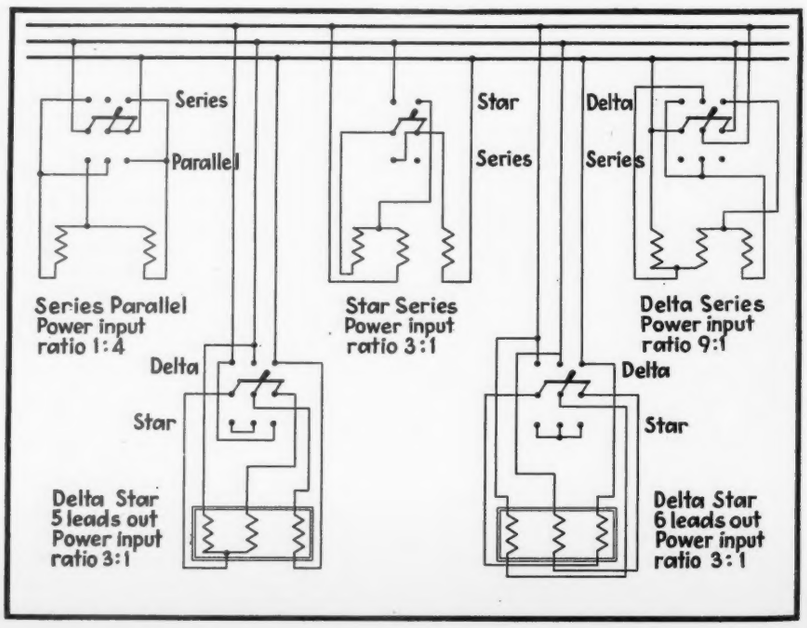

Figure 1. Connections that can be used to control the input to electric heating elements

considered. It appears that the lower the rating in watts per square inch of heater tube surface, the lower the rate at which lime will deposit on the heater. Lime deposits on the heater prevent rapid heat transfer from the element, which in time will cause it to operate at such excessive temperatures that failure results. If the water is not soft, the heaters should be frequently inspected and cleaned.

It is usually assumed that water heaters should be rated between 30 and 40 watts per square inch of heater tube surface. For general application where artificial circulation is not used, oil heaters should have approximately half of this rating.

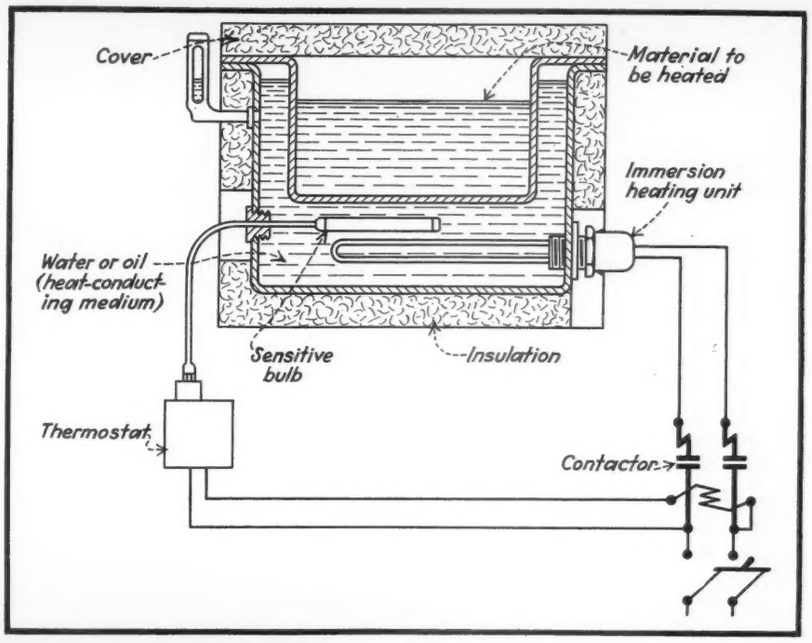

Figure 2. If the element must not be immersed in the liquid to be heated, this arrangement is commonly used

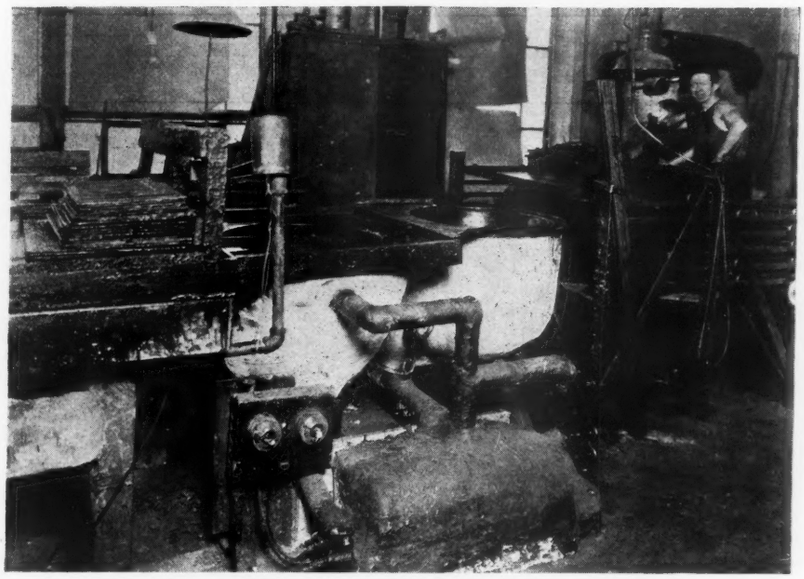

Figure 3. Automatically controlled heaters keep at constant temperature a tank of oil for coating metal parts to prevent rusting

Figure 4. Here steam-jacketed kettles are used for heating mastic. The steam generator is electrically heated, automatically controlled

If oil contains foreign material. it tends to deposit on the heater. producing about the same results as lime. In addition, if oil is heated too rapidly, it tends to "crack" and form a carbon deposit on the heater. which also retards heat transfer and results in short life. Oil must not be heated so rapidly as water.

Heating elements can be furnished with steel, copper, monel, or stainless steel incasing tubes. For some applications they are furnished with lead-covered sheaths. The possibility of electrolytic reaction between the heating element covering and the tank should be carefully considered.

Needless to say, the outside of the tank must be carefully insulated as well as the top, if possible. Much of the loss with any electrically heated bath comes from the top. Even a simple metal cover will prevent air currents, which account for a considerable portion of the losses, from sweeping across the top of the bath.

Electric-Steam Heating

In Figure 3 is shown an application of direct-immersion heaters in a bath of oil and resin. This material must be kept at a certain density to use in coating metal parts to prevent rusting. The work is done in the production line, whereas the tank was formerly located in a separate building because of the fire hazard when it was heated by gas. The automatically controlled temperature of the oil results in a more

uniform coating, saves material.

It is practically impossible to heat tar and mastics with direct immersion heaters, because they will not absorb heat rapidly. Instead of transmitting the heat into the colder parts of the bath, it seems that tar tends to crack and forms a carbon coating on the heater, resulting in short life. Accordingly, steam-jacketed kettles, Figure 4, are commonly used. Immersion heaters are used to generate the steam which heats the kettles. The condensate automatically returns to the generators. A pressure control switch automatically maintains the temperature within the desired limits.

On the other hand, a material for sealing holes in the back of switches is heated, Figure 5, by a direct-immersion heater of a very low rating in watts per square inch of heater tube surface. The nozzle of the container is also heated by a special cartridge heater of very low rating. An automatic feed gives just the amount of molten material needed.

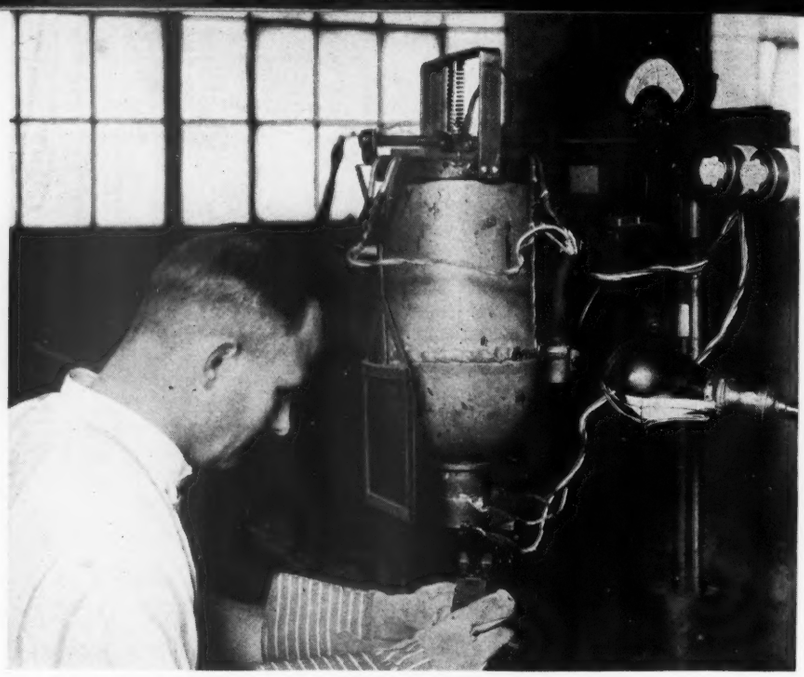

Figure 5. Immersion heaters of low rating melt the compound for sealing small switches

Heating by Direct Contact

Heating of solids is usually effected by direct contact of the heating elements with the material. Cartridge heaters or space heaters are generally used. In some applications so-called straight-length tubular heaters are cast into platens which are machined for use in a manner similar to cartridge heaters. Typical applications are bread wrapping machines, sealing machines, embossing presses, and vulcanizers.

Cartridge heaters are commonly made with a brass, nickel silver, or steel covering. The maximum temperature at which these heaters may be operated is around 750 deg. F. for the brass, 1,000 deg. F. for the nickel silver, and 1,200 deg. F. for the stainless steel sheath. When using these heaters it is important to check the manufacturer's data on the heater to make sure that the heat is taken away from it sufficiently fast so that the element and sheath will not be damaged by overheating.

The best way to keep the temperature of a cartridge heater as low as possible is to provide close contact between the heater and the block in which it is inserted. As a rule, not more than 0.010-in. clearance should be allowed.

In process work air may have to be heated to dry or bake certain materials. Also, it is often necessary to heat air in order to provide the correct temperature for mixing and promoting the reaction of certain materials. Normally this type of heating is done with space heaters; in some applications an open-coil type of heater is used.

A typical open-coil type of heater used for air heating is shown in Figure 6. It is mounted over a conveyor and dries printed material that passes beneath it. The heating is mostly done by radiation, reflected downward from the element.

In one plant in which space heaters are used for air heating, it is necessary that certain liquids be mixed at a definite room temperature. Therefore, four space heaters controlled by a three-heat switch are mounted on the wall and maintain the room at the desired temperature.

In a large woodworking plant it was found that better work could be done if the wood and the glue were maintained at a certain temperature, so that when the glue was applied it ran down into the pores of the wood and insured a tight joint and bond. This procedure was first tried out during the winter.

In Winter and Summer

When the plant heating system was shut down, the problem of operating the warming chamber was solved by placing space heaters underneath the steam pipes. This chamber is approximately 12 ft. 6 in. long, 2 ft. 6 in. wide, and 2 ft. 6 in. deep, inside dimensions. There are 34 sq. ft. of steam pipe radiating surface in it. Eight 500-watt space heaters with a double-throw switch for either half or full heat were installed to heat the chamber electrically, with automatic temperature control.

It was originally intended to use electric heating only during the summer months, but it provided such superior operating characteristics that it is now used the year around.

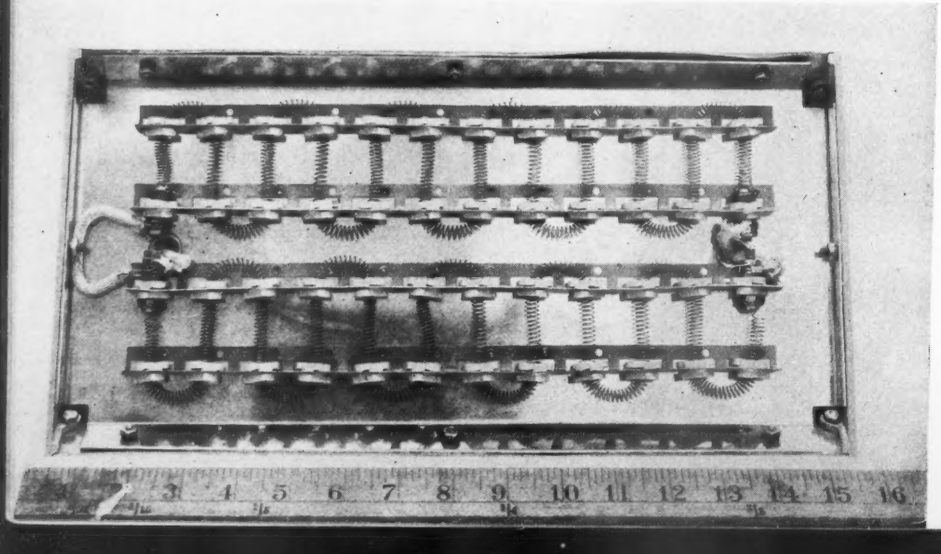

Figure 6. This open-coil space heater is used to dry printed matter passing beneath it on a conveyor

When Wiring Your Plant

Make sure that insulation on wires and cables, and type of construction are suited to the conditions surrounding each installation

F. L. AIME
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IN THE PRECEDING article in July, some of the important factors that influence selection of conductor size were discussed. The next questions that arise are: What kind of wire or cable is the most suitable for a particular condition? What kind of insulation? What type of protective covering? Should cables be single- or multiple-conductor? All of these are pertinent, and the answers should be carefully worked out for each job.

At present several kinds and types of wire and cable are available, most of these varying in type of insulation or protective covering.

All have their field of application, but usually one kind is best suited for a particular case. In each instance that cable should be selected which under the particular installation and operating conditions will give the longest life with the least amount of trouble, and at the same time result in the greatest economy. When these conditions have been fulfilled the best cable has been selected for the job in hand.

It is difficult to set down a strict rule for the proper selection of wire and cable for any job. Usually there are so many variations in the application of cable and the conditions to be met, that each job requires consideration of many items best known only to the man who is most familiar with the work and who is directly concerned with it. This discussion, therefore, should be taken more as a guide than as a set of rules.

Operating Temperature Limits for Insulating Materials

Material	Rated Voltage Kv.	Copper Temperature, Deg. C.
Impregnated paper		
Single conductor	0–5	85
	8.5–30	90-*E**
	34.5	70
	46	65
	69	60
Multi-conductor, shielded	0–5	85
	8.5–30	90-*E*
	34.5	70
	46	65
Multi-conductor, non-shielded (belted)	0–5	85
	6–15	90-*E*
Varnished cambric		
High temperature	(85 deg C. max.)	90-*E*
Standard		75-*E*
Rubber		
Performite	0–8	75
	8.1 and over	70
A.S.T.M., 30% grades		60
Code		50
Asbestos		
All asbestos, no moisture content		200
All asbestos, moisture present		125
Asbestos and varnished cambric		100-3*E*
Asbestos and high-temperature v.c.		115-3*E*

*E = Operating voltage in kv.:
1. Between conductors in multi-conductor, non-shielded (belted) type cable.
2. Conductor to sheath in single- and multi-conductor, shielded-type cable.

Rubber or Varnished Cambric

Frequently, two or more types of cable offer the same characteristics as to life and reliability. In such instances economy only will determine which is to be chosen. The manufacturer of wire and cable has become quite diversified in the past ten years, because of the wide variety of rubber compounds, and a great many new protective materials have been made available.

The most common insulating materials used in industrial installations are rubber, varnished cambric, and paper. All are used for the low and intermediate voltages, but paper is more frequently used for the high voltages. Except for incoming power supply circuits of 13.8 kv. and above, or in large industrial plants where high-voltage feeders are used for distribution, the general run of insulation is likely to be rubber or varnished cambric; occasionally paper will be used.

The table shows the operating temperature limits for the different insulating materials.

Inherent qualities of rubber compounds have made them nearly ideal insulating materials, but for many years certain limitations prevented their wider use. These included poor aging qualities, rapid disintegration at the higher operating temperatures, susceptibility to corona cutting, and relatively low dielectric strength. Progress in manufacture has succeeded in removing many of the deficiencies of rubber compounds, greatly widening the scope of their usefulness. Compounds are available today that have excellent qualities for applications under conditions for which they were formerly poorly fitted.

The more common insulating compounds in use today are Code, Intermediate, A.S.T.M. Types AO and Performance. The most recent addition to the A.S.T.M. Specifications is the Performance type, showing clearly the trend of the industry to adopt performance specifications and abandon chemical control. These compounds are simple in electrical and physical properties and are widely understood; hence, they have become standard for everyday use. Other compounds, based on performance, are more complex and less widely known. They are made for more special applications, and are offered as special compounds.

Insulation Is Improving

With the aid of modern discoveries, particularly anti-oxidants and accelerators, there have been developed additional compounds to meet nearly all service requirements, and the list is still growing. Among these compounds are:

A longer aging and greater heat-resisting compound than that con-

templated by A.S.T.M. Type AO, known as Performite; high-voltage, ozone-resisting compound; Network cable compound; heat-resisting rubber compound; moisture-resisting compound; flame-resisting, building wire compound.

Some of the more common protective coverings are: A.S.T.M. Braid with weatherproof saturant; seine twine or hawser cord braid; sisal braid; asbestos braid; woven-cover, (fire-hose weave); rubber and synthetic jackets; saturated jute and fibrous armor for direct burial; jute and flat-metal-tape armor, such as plain or galvanized steel or bronze; interlocking tape armor; steel, copper, and bronze wire armor.

Besides these, there are outer protective coverings designed for additional protection of the cable. Among these are duck tape; jute, asphalt and duck tape; special moisture-resisting tapes; and asbestos. Included in the saturating and finishing compounds that can be used with braided and woven coverings are Safecote finish; moisture-resisting and flame-retarding saturants and finishes; slow-burning paint fill; lacquers; and special finishes.

Rubber, varnished-cambric, or paper-insulated cables are equally dependable, regardless of circuit importance, when properly designed for the conditions to be met. Reliability is important for all circuits because production losses incurred by interruptions on important feeders may cost more than the most reliable circuit constructions.

Each Has Advantages

In the order of their importance, and the extent of the effect that their failure might have, main feeders should be the most reliable. Subfeeders are next, followed by branch circuits.

For power and lighting circuits up to 600 volts, rubber-insulated wires and cables are usually employed, especially in the smaller sizes, because: (1) They are easily pulled into conduits and raceways; (2) they are flexible; (3) the insulation offers moisture protection; (4) 600-volt conductors can be safely and dependably insulated with rubber.

Several well-known rubber compounds are available for ordinary, moderate conditions of temperature, moisture and so on, such as Code, Intermediate, and 30 per cent. Special compounds are used for more severe conditions and where greater life and dependability are demanded; some of these have already been mentioned. Standard building wire and cable for circuits of 600 volts or less have rubber insulation, and may be satisfactory for either power or lighting circuits.

Varnished-cambric-insulated wires and cables also are used for this voltage. Reasons are:

1. Where larger-size conductors are required, varnished cambric usually affords greater flexibility.

2. It is selected by many for hard service and is preferred in some industries, such as steel mills, for its greater reliability under their operating conditions.

3. It permits higher copper temperature than some of the standard rubber compounds and, therefore, makes it possible to carry more current without shortening cable life.

4. Varnished-cambric cables can be terminated indoors without potheads.

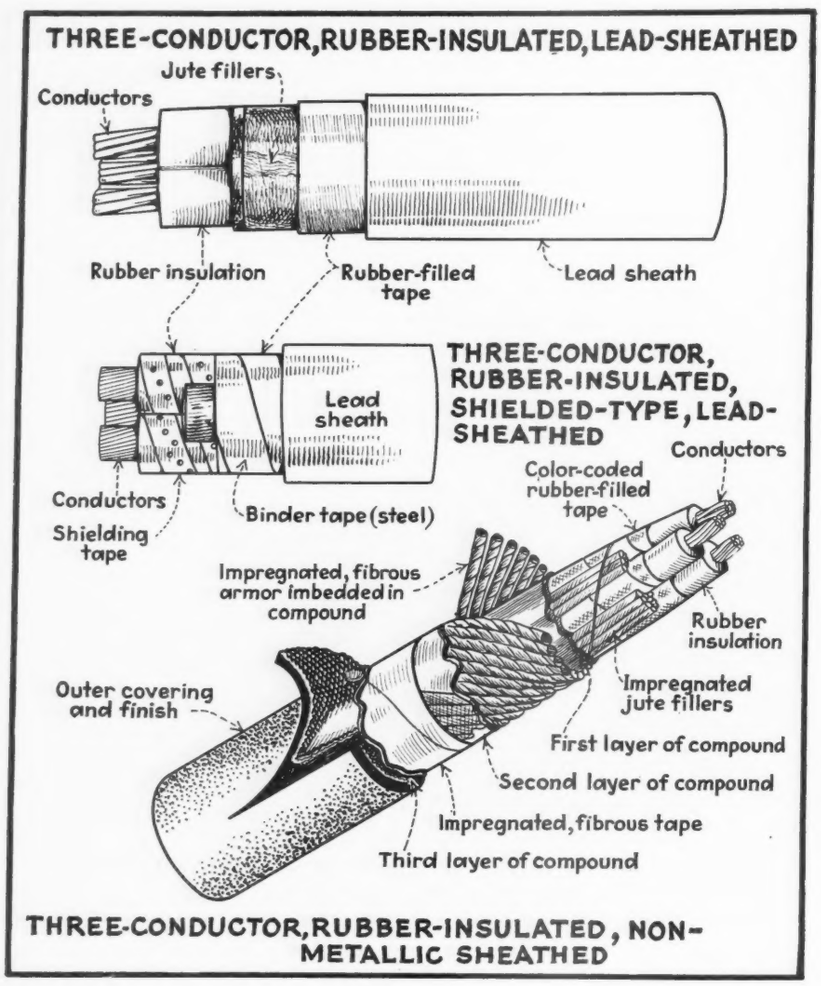
Paper and Asbestos Stand Heat

Paper-insulated cables must have a lead sheath; consequently, there are some instances where these cables are at a disadvantage, especially in large single-conductor sizes carrying heavy currents, where high sheath losses may result and surrounding conditions may cause electrolysis or corrosion. It is true, however, that paper-insulated cables can be employed to good advantage when copper temperatures of 85 deg. C. are not objectionable, or when the highest reliability and longest life are desired.

Asbestos and varnished-cambric insulated cables are selected when they must operate at unusually high copper temperature (above 85 deg. C.), because of a high ambient.

All-asbestos-insulated cables are able to withstand a maximum conductor temperature of 200 deg. C., and are used for operation up to 600 volts when the temperature is unusually high. Both types require that moisture conditions be carefully watched.

(A succeeding article by Mr. Aime will appear next month.—Ed.)



Give Unit Heaters a Break

It can be done by taking advantage of, rather than opposing, basic laws governing the action of heated air and the transmission of heat

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Newark, N. J.

MANY HAVE the impression that it is necessary only to pour volumes of heat into a building, until it is eventually heated. Generally speaking, this is true, if uniform distribution and heating costs are disregarded. However, the hypothesis often fails.

Heating a building is like filling a gallon measure with water. If there are leaks, the rate of filling is retarded, and more than a gallon will be consumed. The leaks may be of such size as to make it impossible ever to fill the container. Waste results, whether the fluid be water or heated air.

Heat may flow in any of three ways, or some combination of them.

Radiation is the direct transfer of heat between two bodies separated from one another. It takes place without any conveying medium and will pass through air or other gases without heating them.

Conduction is the flow of heat through a body, or adjacent bodies, between two points at unequal temperatures. The well-known transmission values for building materials are based on the rate of conduction.

Convection is the transmission of heat from one body to another by means of a circulating medium (liquid or gas).

Transmission of heat by radiation is relatively unimportant in comfort heating work and usually is neglected. But, transmission by convection is the most effective means of conveying heat into the working areas of a building. The unit heater is designed around this principle.

There are certain well-known and accepted laws governing the behavior of warm air and the application of heating devices. If these are well understood, selection and location of unit heaters becomes a rather simple process. For example:

1. *Warm air rises.* Air, heated above the surrounding temperature, tends to rise vertically upward unless controlled. It may be controlled by imparting to it sufficient velocity to overcome this tendency.

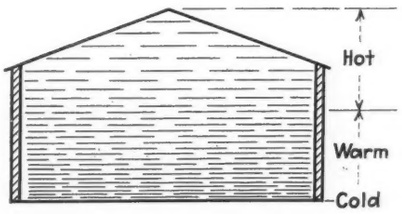


Fig. 1. In a room or other sizable area the air tends to separate into layers, the relatively hot air going to the ceiling and the cold air to the floor, with a warm zone in between

2. *Warm air stratifies.* The natural tendency is for heated air to stratify within an inclosure. Therefore, the air temperature at the ceiling will be much higher than at the floor. Figure 1 illustrates this normal stratification.

3. *Air moves horizontally* through its own temperature stratum with the least energy requirement.

4. *Additional energy is consumed* when warm air is blown down through layers of cold air, or cold air is blown upward against gravity into a zone of lower density.

5. *The convection principle,* or circulation of heat-laden air through the zone to be warmed, is essential to the most efficient warming of that zone.

6. *The cold air stratum* at the floor line cannot be effectively removed and carried upward through a warmer air stratum except by the use of ducts or conduits, even though mechanical means be used to create velocity or pressure or both.

7. *Blasts of hot air* moving at appreciable velocities within the working zone must be avoided in the design of practical, comfort-heating systems.

Considering unit heaters for a moment, it can be said that they possess five distinctive features:

1. *High heat transfer.* Under gravity circulation the B.t.u. given off per square foot of surface per hour at 2-lb. steam pressure, with air at 60 deg. F., is usually considered as 240. A unit heater emits from seven to eight times as much, due to the high air velocity across the heating surface. This feature makes possible large heating capacity in a small space.

2. *Low final temperature.* The average normal outlet temperature

Average Temperature Variation per Foot of Elevation Above Floor

Type of Unit	Degrees Rise in Temperature per Foot Rise Above Floor 5 to 25 ft.	Above 25 ft.
Blower type, floor mounted, with low-pressure steam and standard coil	0.5	0.15
Blower type, floor mounted, with high-pressure steam and standard coil	0.8	0.20
Blower type, floor mounted with high-pressure steam and low-temperature coil	0.5	0.15
Blower type, ceiling suspended, with low-pressure steam and standard coil	0.8	0.20
Blower type, ceiling suspended, with high-pressure steam and standard coil	0.9	0.25
Blower type, ceiling suspended, with high-pressure steam and low-temperature coil	0.8	0.20
Propeller-fan type, low-pressure steam	1.0	0.30
Propeller-fan type, high-pressure steam	1.1	0.35

Note: Steam below 15 lb. is considered low pressure, and above 15 lb. high

is 125 deg. F. for air entering at 60 deg. Certain conditions, discussed later, permit considerable variation in outlet temperature. This feature bears an important relation to the first fundamental law, mentioned previously.

3. The initial flow of air is in a horizontal or near-horizontal direction, important from the standpoint of laws *3*, *4*, and *7*, above.

4. The initial velocity of air ranges from 500 to 2,500 f.p.m., depending on the class of unit. Laws *1* and *2* are concerned with this feature.

5. Due to the high outlet velocity and shape of the discharge casing, room air is sucked into the primary hot air stream. The amount varies from one to three times the initial air volume of the unit, depending on its type. A practical effect is quick mixing with room air and a lower temperature diffusion.

With proper selection unit heaters will maintain low average temperatures. It would be possible, but not practical, to heat a building to 70 deg. F. with air at 71 deg. F. The practical limitation is, of course, the quantity of air handled and the horsepower expended. Low average temperatures always mean less heat loss from a building because the temperature differential, or pressure causing the heat flow, has been decreased.

Observation of many installations indicates that the average temperature variation per foot of elevation for various types of unit heaters, under an outdoor temperature of 40 deg. F., is as shown in the table.

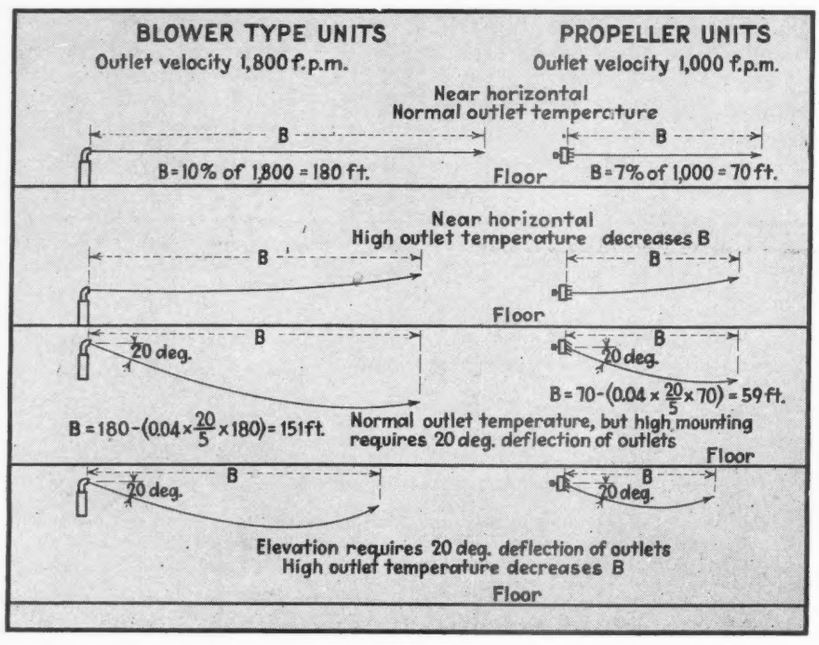
Therefore, when selecting unit heaters keep this table in mind and let the essential requirements determine the class of unit. Unwillingness to surrender floor space may require compromising with the possibilities for maximum fuel saving. If saving of fuel is no object, power costs may be high and thus dictate units that consume the least power. Again, there may be certain applications where one, and only one, class of unit can be used, regardless of the desirability of minimum power and fuel consumption.

Initial cost of the installation is another factor to consider. This includes the cost of traps, fittings, piping, wiring, and labor, as well as the cost of the units. Economies not always considered can sometimes be brought out by this comparison.

Two Classes of Heaters

As indicated by the table, there are two general classes of unit heaters, distinguished by the type of fan used. One is the propeller fan; the other, the blower fan. The field of application for each is very broad and it is sometimes difficult to say where one should be used to the exclusion of the other. The following comparisons will serve as a guide, and should be interpreted in the light of the job at hand.

Fig. 2. Relative distance of blow obtained with blower- and propeller-type units under different conditions



Pressure. The blower type is essentially a high-pressure, and the propeller type essentially a low-pressure, unit. The former is capable of handling air against greater resistance, such as imposed by high outlet velocities, fresh air intakes, special duct work, filters, and so on. As resistance increases, the horsepower of conventional blower fans decreases. With propeller fans, the horsepower increases with an increase of resistance.

Velocity. Outlet velocity of the blower type may be as high as 2,500 f.p.m. For propeller units it is much lower, usually not exceeding 1,000 f.p.m. This high velocity makes possible longer distance of blow and greater coverage. It permits warm air to be blown down from a considerable height into the working zone, since the kinetic energy necessary to pierce the cold air layers is available within the air stream. Consequently, a blower-type unit will have greater coverage area and more flexibility as to location than a propeller unit of equal capacity.

Induction. Due to high outlet velocity and shape of discharge outlets the blower unit will induce more secondary air than the propeller unit, resulting in more rapid and complete turnover of the air within the building.

Stratification. Because of the higher discharge velocity and greater induction, the blower type produces lower temperature stratification.

Horsepower. Because it operates at lower resistances, the propeller unit will handle a given quantity of air with lower power consumption. This is a distinct advantage where the cost of electric power is high.

Coverage. Because of the high discharge velocity, blower units can be built in capacities of well over 1,000,000 B.t.u. per hour per unit, and a single unit can effectively cover an area that would require several propeller units.

Cost. The blower type is more expensive to build, and on a unit basis represents a higher cost per 1,000 B.t.u. Other characteristics, however, usually compensate for the higher unit cost.

Mounting height. All unit heaters should be located as near the floor line as possible, consistent with the ability to deliver warm air *over* the heads of the occupants and not *on* them. The optimum location for the centerline of warm air discharge is 9 ft. above the floor.

Propeller units should *never* be located more than 18 ft. above the

(*Continued on Page* 152)

Prepare to Paint

What every plant man wants is the best possible paint job at the lowest possible cost. Surest way of getting it is to see that no one slaps on good paint until the surface has been properly prepared

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The Eagle-Picher Lead Company
Cincinnati

AROUND manufacturing plants. painting is done primarily for preservation, although appearance sometimes is also of importance. When it comes time to paint, however, the fact to keep uppermost in mind is that the surface is the thing to concentrate on.

What any plant man desires is the best possible paint job at the lowest possible cost. It is, therefore, astonishing to observe how often the painters are encouraged, or at least permitted, to slap good paint on surfaces that are improperly prepared, or perhaps not prepared at all. If the surface is in poor condition, the paint cannot cling to it, or else it may scale off along with some of the surface material. On the other hand, reasonable expenditure of time in preparing the surface would permit the paint to perform its job effectively for years to come.

Depends on the Surface

Three general classes of surfaces are involved in exterior and interior plant painting: (1) Masonry, including concrete and plaster; (2) wood; (3) steel or iron. These surfaces all require distinctive treatment if the paint job is to be a good one. And it is exceptional to find a surface that can be properly painted without some preparation.

On masonry, so long as the film of preceding paint coats is intact, nothing need be removed. If the paint has begun to scale, it is essential to knock off the loose material, usually done well enough with a wire brush or scraping knife. Even when the paint film is of considerable thickness, it is not necessary to remove it unless the surface has begun to crack, chip, or peel.

The amount of surface preparation depends principally upon the appearance requirements. If preservation is foremost it is only necessary to knock off anything which might come loose. If appearance is important, it may be necessary to burn or steel-wool, or even remove the surface with paint remover.

When remover is used, the surface must be well washed afterward with gasoline or turpentine and permitted to dry before painting; if even a trace of remover remains upon a surface before painting, the new paint job will not last long.

Moisture is a major hazard in painting masonry. It is well known that masonry walls are varyingly permeable to moisture, and it is safe to assume that any wall under consideration is highly permeable. Moisture on a surface to be painted is sure poison to the paint. On masonry it causes an efflorescence or surface mottling which can always be recognized.

If moisture is evident on or in masonry, it is essential to stop it at the source and get the masonry dry on and some distance below the surface, before painting. For example, a leaky steam line just inside an outer wall is enough to prevent successful painting.

Acid on a surface is another real danger. If it is coming from beneath the surface, it is questionable whether a suitable surface can be created until the acid supply is cut off and neutralized. If the acid on the surface results from leakage above, or condensation of acid-making fumes, the surface can be adequately prepared by giving it a strong alkaline wash. For this purpose use a strong solution of a strongly alkaline washing powder. After washing, rinse well and allow the surface to dry thoroughly.

Allow new masonry to dry out for several months. There is likely to be

free alkali in a new masonry wall, which will tend to be neutralized in time. When the time comes to paint, it is easy to test for alkalinity. Get a saturated solution of phenolphthalein from the laboratory or a drug store and apply it to the surface. If the surface is alkaline, the phenolphthalein will turn pink or red.

Free lime in mortar or on masonry may cause "hot spots" or lime burns by reacting with the oils in the paint. Moisture increases the action. To avoid it, make a solution of 3½ or 4 lb. of zinc sulphate to a gallon of water, and apply to the surface. Allow to dry before painting.

Grease spots on the masonry may be removed with benzine or other good grease solvent.

Seal the Surface

When painting a masonry surface for the first time, apply a sealing coat after the surface has been prepared. The best sealing coat is made of spar varnish lightly pigmented with white lead. This will seal the surface and serve as the necessary undercoat. Over the sealing coat apply a gloss, semi-gloss, or flat coat. Only now it is time to apply paint of the desired color. White lead with a moderate percentage of zinc oxide, in linseed oil, is an excellent paint for masonry thus prepared.

If there is excessive moisture, use of chinawood oil and synthetic resin paints may be indicated.

Fundamentally, the preparation of a wood surface for painting is essentially the same as for masonry, although it is seldom advisable to use paint remover on wood surfaces. The appearance desired must set the extent of treatment in smoothing up the surface for painting.

With new wood surfaces it is necessary that all knots and pitch streaks be painted over with red lead, shellac, or aluminum. The hard film produced by these coatings is sufficient to prevent the resin coming through.

White lead in oil, with a volatile solvent such as turpentine, is usually safest as a primer or undercoat to form a good bond between the wood and subsequent coats.

Some Brush It Out

It is dangerous to generalize about any painting problem, because there are always some variables to reckon with. Perhaps the painter has been taught to brush out a heavy paint. Possibly he does not use it heavy, but thins it and flows it on. One painter will apply much more material to a surface than will another, using the same paint. White lead paint should always be brushed on—never flowed on.

Also, there are variables of lumber and climate. Lumber is not all alike; even one board may show considerable variation. A standard example is the board with a hard, resinous section at the top; a softer, more absorbent, spring-growth section in the middle; and a grayish, spongy strip in the first stages of decay at the bottom. This is an extreme, but possible example.

It is important that a new surface that is rough and splintery be primed with a sufficiently heavy priming coat to serve the purpose. A painter often thins this primer to overcome the brushing difficulties and thus produces a surface which will always make bonding difficult.

When new boards exude balsam, a small quantity of bodied linseed oil should be included in the paint.

Atmospheric variables can be taken care of merely by exercising due precaution. In spring and fall, particularly the latter, the weather may be decidedly erratic and hard on the painting. A bright, warm autumn day may be followed by a cool, dewy, or even frosty evening. Next morning the surface is covered with the familiar fine globules of moisture. Painting too early in the morning causes serious trouble. Wait until the surface has really dried off. It is safe to paint in any kind of dry weather, in any season.

Beyond having the surface dry, the only essential precaution is to stop work early enough in the afternoon to give the paint a chance to "set up," or become a film rather than a liquid surface, before night. It is essential only that the air be dry. Cool weather and high humidity may ruin the best paint that can be produced.

For Steel, Sandblasting

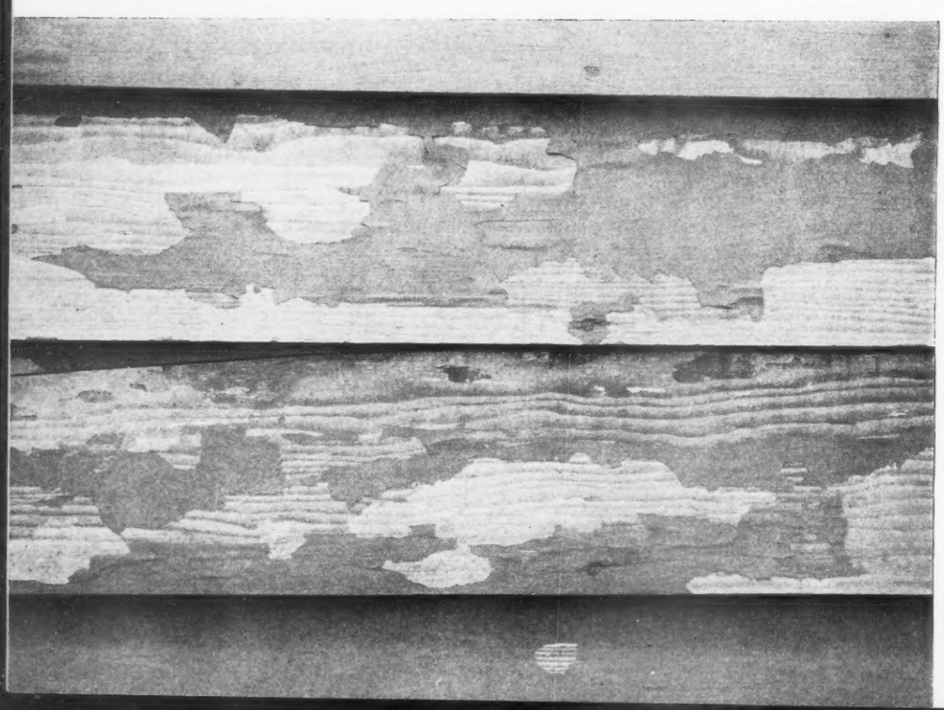
In preparing a steel surface for painting, remove all material that is loose or will become loose. Rust is the most important item. The ideal way to prepare a steel surface is to sandblast it. Burning is also effective. Acetylene torches give greater heat and higher concentration than a blowtorch.

Where the surface is not in bad shape, and preservation rather than looks is sought, it can be well prepared by removing loose paint and rust with a steel wire brush. Rust scale is the real danger to a good paint job on steel, and it must be removed.

It is particularly important to clean steel sash properly, because it is subject to much more intensive corrosion than most other steel surfaces. Also, it pays to use a rust-inhibitive paint.

Most, if not all, corrosion arises from the presence of ionized iron, which ordinarily cannot occur without the presence of water and an acid. At ordinary temperatures, plain unpainted iron in perfectly dry surroundings hardly rusts. It is only when water is present and oxygen reaches the surface that corrosion occurs, unless there is exposure to acid. This condition is not rare, but it is of far less indus-

(*Continued on page* 160)



Failure of a paint film may be due to any one of several conditions. Whatever the cause, the result is eventual destruction of the underlying material

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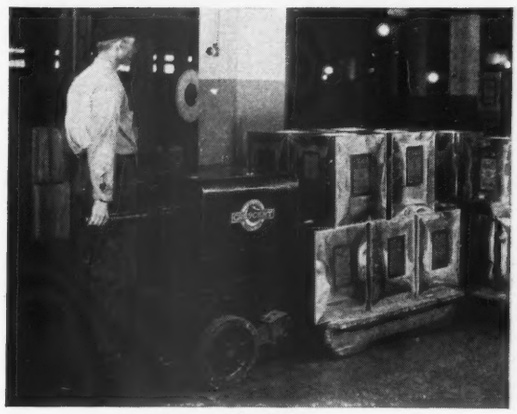


Crescent Truck Company

Easton Car and Construction Co.

Wright-Hibbard Industrial Electric Truck Co., Inc.

You want to know

and the editors will gladly tell you more about the things mentioned on this page

WHEN you move between 15 and 25 tons of coal a day as these miners do, you should be critical of shovels and know what makes a good one. The man in the foreground developed this aluminum shovel and, in spite of its slightly greater cost, many of his fellow workers are buying them, for the lighter weight means the work can be done with less effort. (8720)

• HEALTH HAZARDS of welding operations are subject of a booklet which compiles what has been learned about protecting operators on welding, cutting, and coating jobs. (8701)

• WASHER DATA CHART, for hanging in stockroom or engineering department, gives size and dimension data of full range of standard wrought washers. The more frequently used washers are shown in exact size so that unknown washers can be identified. With it you can be sure of selecting the right size for a given job. (8702)

• SOLDERING FLUX for stainless steel, long difficult to solder, requires no special equipment or solder, does not give off offensive odors, will not burn hands. (8703)

• BLACK MARKS against American life show up in the 1937 edition of "Accident Facts," a statistical, graphical record of last year's accidents. Perusing it is guaranteed to make one more careful. (8704)

• WOOD PANELING, made of a real wood surface bonded to fiber board by a waterproof synthetic resin, will dress up the office. It can be used for wainscoting, wall covering, window backgrounds, and the like. With no special preparation it can be nailed or glued to old walls. (8705)

• OBJECTIVES of a labor policy and the human problems of management are discussed in two booklets published in England. They give some idea of how employee relations shape up in the British point of view. (8706)

• WITH not only a neon light indicator to show the fuse is blown, but an attached fuse puller besides, a line of cartridge fuses has everything to be desired short of actually making the fuse replacements. (8707)

• NEOPRENE is a material heard much of these days. An attractive booklet gives its history, tells what it is, what its applications are. (8708)

• WANT TO KNOW what a traffic manager does? Report cites cases from individual companies, shows what is common practice in traffic department organization, place of the traffic manager in the company organization. It also deals with measurement of performance and gives composite picture of 24 traffic departments. (8709)

• WELDING DESIGN CHART, revised to feature latest weld symbols, is mighty handy in the engineering drafting room. In addition, it contains a raft of miscellaneous welding information. (8710)

• ENAMEL, which is said not to show dust or dirt marks and to hide surface scratches to some degree, can be used for general finishing work. (8711)

• BY FAR the smallest, most compact communicating system to come to our attention is one with a two-way instrument about half the size of a French phone. The same instrument acts as both receiver and speaker. (8712)

• WINDOW WASHER cleans, dries, and polishes windows without making you get your hands wet. Has hollow shell molded of plastic with a sponge rubber cleaning pad cemented in the bottom. (8713)

• RECORDS SAFE, for files of 5x8 and 5x3 cards, gives 2-hour fire protection. Door is on top and is counterbalanced to swing aside easily. Once opened, card holders are moved up into working position. Has combination lock. (8714)

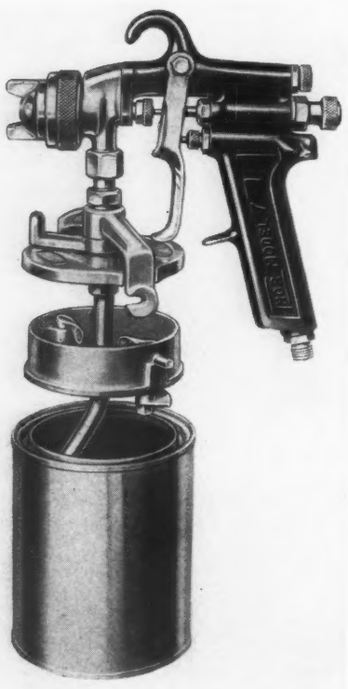
• EMULSIFIED LACQUER has dual uses—as a non-absorbent sizing coat for wall board which is to be covered with other coating materials, as a leakproof interior coating for paper lubricating-oil containers. (8715)

• ELECTROPLATING in colors is accomplished by a process which employs only a single copper anode and a single electrolyte to achieve results. The color range is almost that of the spectrum, it is said, and particular shades can be reproduced. (8716)

• LABELS, two sets of them, come in handy kits, one for use in the mailing department, one for the executive's desk. The latter set has such orders as "rush," "approved," "follow up." Mounted in rolls, and gummed, they come five rolls to a kit. (8717)

• PENCIL, of the mechanical variety, has a roll of memo paper in its case. A flick of a finger in the oval opening at the side produces the paper. (8718)

• REPAIR FLOORS with a material suitable for patching and resurfacing concrete, wood, tile, and brick. In powder form, it is mixed with water, and sets in 8 hours. Traffic can pass over it in 15 hours. (8719)



ORIGINAL PAINT CAN can be used as a spray-gun cup if you have one of these adapters around. They fit most standard cans and changes from can to can and color to color can be made quickly. To attach, simply place adapter on top of can and tighten lever clamps on the inside. (8712)

Increase your profits with J&L STEEL

"J&L Seamless Tubes keep the boilers working" . . .

"They're stronger... they last longer and... they roll-in faster."

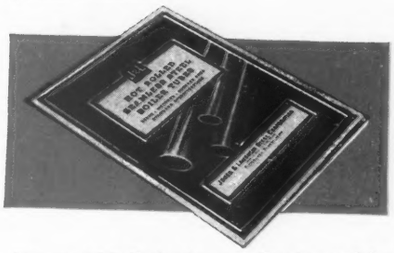
An *extra* margin of strength, safety and high ductility is built into every length of J&L Seamless Boiler Tubes.

Strength and safety come from the fact that the tubes are rolled from solid billets of selected steel. There are no welds—*therefore there can be no failure at or near a weld.* High ductility is a result of the effective forging action that characterizes the J&L method of manufacture.

This combination of strength, toughness and durability means that you can depend on J&L Seamless Boiler Tubes to stay at work longer and to keep the boilers working with a minimum of shutdowns.

Because they are more ductile, Jones & Laughlin Seamless Boiler Tubes roll-in faster. They "stay put." With these boiler tubes you save money, for they can be installed in minimum time and at low cost.

They are available in a full range of standard sizes—1" to 6" O.D. inclusive . . . and comply with all recognized boiler specifications. For better boiler tubes and lower costs, use J&L Seamless.



This special bulletin gives specifications and describes the methods by which J&L Seamless Boiler Tubes are made. It is available without charge. May we send you a copy?

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PITTSBURGH, PENNSYLVANIA

MAKERS OF HIGH QUALITY IRON AND STEEL PRODUCTS SINCE 1850

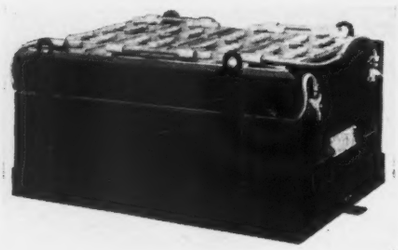
What's New in Equipment

Group Locker

"A-S-E Unit Robe" is a steel group locker which will accommodate 16 persons in approximately ½ sq. ft. of floor space per person. Made up of box locker units 12 in. wide, 12 in. high, by 18 in. deep, assembled in two vertical columns of 6 units each, connected across the top by a horizontal section of 4 units. Directly

underneath is a coat hanger rod to accommodate the outer garments of 16 or more persons. Constructed of steel channels and ⅛-in. steel angles, riveted together. Can be set up in single rows or back to back in double rows. Sections can be bolted together in groups of any number. All-Steel-Equip Co., Inc., Aurora, Ill.

Storage Battery



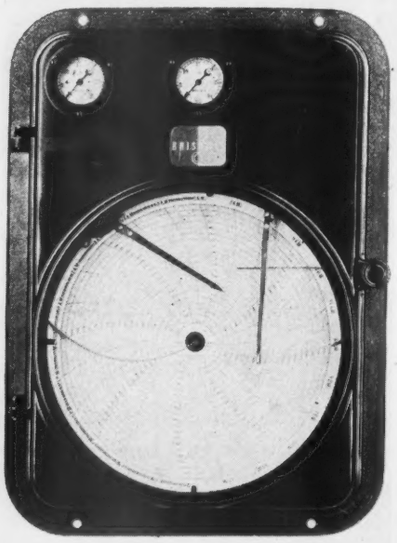
USL Durapak storage battery for use in trucks. Major feature is a positive plate having the following advantages: special sectional construction to withstand expansion and contraction stresses; heavy, one-piece interlocking plate grid; machine-pasted plates for greater plate uniformity; glass fiber retainer pads to prevent loss of plate material; special plate shielding to hold glass fiber retainer pads firmly against plate surface and permanently shield entire plate. Has long-life rubber separators to balance long service life of the positive plates. Negative plates have tapered tops and insulated edges for extra protection against short circuits. USL Battery Corp., Niagara Falls, N. Y.

Welding Electrode

Arc welding electrode developed especially for flat welding of deep-groove joints in mild steel. Called "Fleetweld 9." Provides weld deposits possessing high physical properties. Operated with a.c. or d.c. Made in three sizes, $\frac{3}{16}$, $\frac{1}{4}$, and $\frac{5}{16}$ in. The Lincoln Electric Co., Cleveland.

Pyrometer Controller

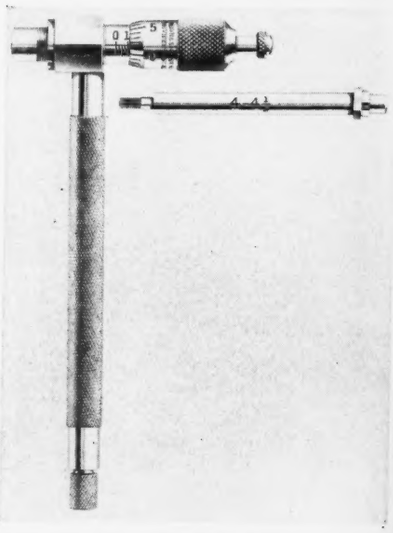
Round-chart pyrometer controller is known as "Pyromaster Controller." It is a potentiometer pyrometer available in both pneumatic and electric types. Uses standard thermocouples and extension leads and is for direct ink-marking on a round



12-in. chart, or for indicating on a large scale. It is said to require no lubrication, and not to be affected by vibration. Automatically self-balancing and self-compensating for temperature changes. Available as recorder, recorder with indicating scale, recorder controller, recorder controller with indicating scale. The Bristol Co., Waterbury, Conn.

Micrometer

Telescoping Inside Micrometer No. 268 makes inside measurements in thousandths of an inch. Has range of 2 to 6 in. Combines advantages of a telescoping gage and inside micrometer. Is inserted into hole or recess, with the telescoping measuring point adjusting itself to the work. Setting is locked by the knob at the end of the handle. The tool is withdrawn and the micrometer thimble turned until it contacts the shoulder of the measuring rod. Provision is made for adjustment of wear of the measuring points. Brown & Sharpe Mfg. Co., Providence, R. I.

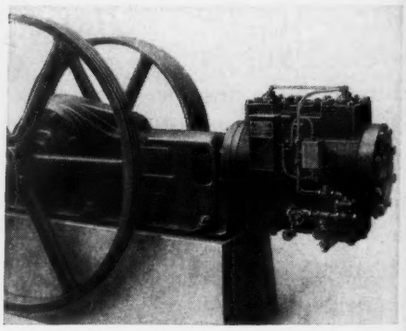


Circuit Breakers

"Thermomagnetic Overload Feature" is applicable to all a.c. types of the company's motor-protecting circuit breakers. This device is said to discriminate between normal and unsafe overloads. It permits full-voltage starting, even when the accelerating period is unusually long and the inertia load exceptionally heavy. The breaker is tripped before dangerous temperatures are reached in a motor or in the device itself. With overcurrents of short-circuit intensity tripping is instantaneous. Available for any type of a.c. motor up to 1,000 hp., 550 volts. I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia.

Compressor Control

Automatic start-and-stop control, combined with automatic loading and unloading, is available on motor-driven single-horizontal compressor with use of



this new magnetic unloader. It operates on standard electric equipment and can be installed wherever a conventional automatic starter is used for controlling the compressor motor. A pressure switch is required to operate a pilot circuit. This switch control is transferred electrically from the motor starter to the magnetic unloader, and either position may be

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- **PROTECT LIFE AND PROPERTY**—Use Master Explosion Proof Motors in presence of explosive gas or dust.
- **FOR EXPLOSIVE GASES** — One type approved by Underwriters Laboratories for Class I Group D hazardous gas locations.
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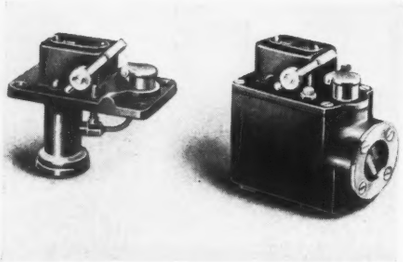
- **GEARHEAD EXPLOSION PROOF MOTORS** available with Underwriters Laboratories approval nameplate.
- **A COMPLETE LINE**—1/8 to 75 Horsepower.

THE MASTER ELECTRIC COMPANY, DAYTON, OHIO

selected at will. If connected to the motor starter, the compressor starts and stops on the demand for air. When connected to the magnetic unloader the compressor runs continuously and simply loads and unloads depending upon whether or not air is needed. If desired, the cooling water supply can also be automatically controlled. It also functions as a starting and stopping unloader. Worthington Pump & Machinery Corp., Harrison, N. J.

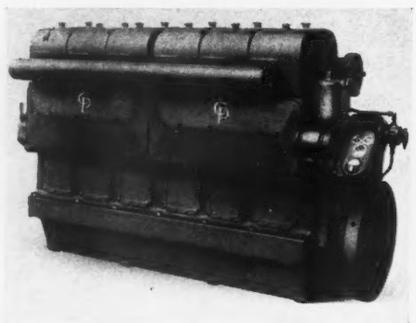
Lubricator



Type L automatic lubricator has reservoir capacity of one-quarter pint. Is designed to be used in connection with a centralized forced-feed lubricating system. Pressing small lever with the finger raises piston through a definite stroke drawing oil into the pump cylinder. When lever is released, the needed quantity of oil is discharged under action of the piston-return spring into the tubing system. This develops a pressure of about 50 lb. in the system. Piston stroke is adjustable, and may be set to give oil delivery of from 2 to 30 drops. Bijur Lubricating Corp., Long Island City, N. Y.

Diesel Engines

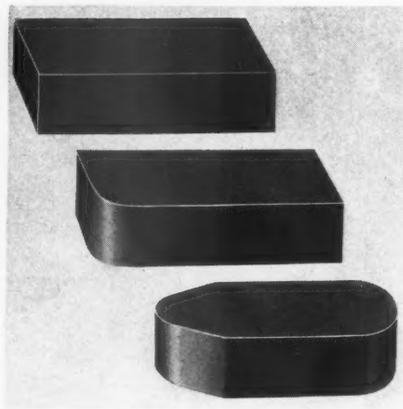
Type 8 CP diesel engines for continuous heavy-duty come in 3 to 8 cylinders and 90 to 300 hp., are four-cycle, direct-injection type. Standard accessories are externally mounted and removable as complete units for repair or replacement.



Speeds of 600 and 720 r.p.m. Fuel economy is said to be equal to large low-speed diesels. All wearing parts are completely inclosed and all lubrication is automatic. Chicago Pneumatic Tool Co., 60 East 44th St., New York.

Soldering Flux

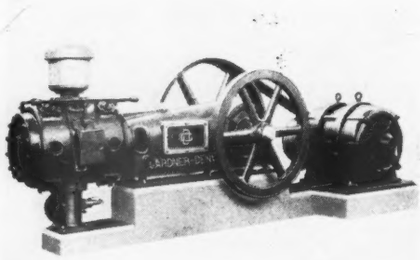
Flux for stainless steel, copper, brass, Monel metal can also be used in soldering cast iron, black sheet iron, and carbon steel. It is said not to give off noxious fumes when it is heated, and it is soluble in water. It comes in liquid form. Alumaweld Co. of America, South Parkway, Chicago.



Carboloy Blanks

Three styles of standard Carboloy blanks are available in 96 sizes. It is said they are adaptable for use on more than 90 per cent of all carbide tools in use today. Savings in the use of these blanks is being featured by the manufacturer, inasmuch as the manufacture of large quantities of standard sizes makes possible lower prices. Carboloy Co., Inc., 2999 East Jefferson Ave., Detroit.

Compressor



Improved single-stage horizontal air compressor for heavy duty service in continuous operation. Known as the "RX" compressor, it has totally inclosed dust-proof construction, and is said to have accurate balance and freedom from vibration. Has electro-pneumatic control with which the compressor always starts unloaded, and the air supply is automatically adjusted to fit the air requirements. This is said to result in part-load economy. Equipped with adjustable roller main bearings. Gardner-Denver Co., Quincy, Ill.

Ice Cream Vending Machine

"Frost-O-matic" ice cream vending machine is now available for installation in factories. Delivers a five-cent package of ice cream in perfect condition, regardless of outside temperature. It uses, for the refrigerant, dry ice, so no electrical connections are necessary and the machine can be shifted from location to location at will. Occupies floor area of 18 x 40 in. Ice Cream Venders, Inc., 9 Rockefeller Plaza, New York.

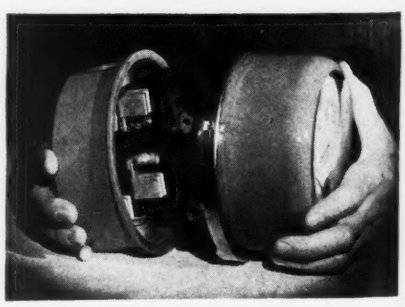
Hoist

"Power Master" hoist features gravity lowering speed controlled by clutch and governors, close control of stopping position, free chain for quick adjustment to the load. Convertible in capacities of 1½ to 6 tons. Has precision sealed ball bearings with planetary gear system sealed and running in oil. Manufacturer states that all models are tested to 100 per cent overload. Coffing Hoist Co., Danville, Ill.

Welding Fluxes

Three fluxes in powder form are intended for use on heavily coated welding rods. Application can be made by dip coat or by extrusion. Called Rutile, Rutile-B, and Titanate. Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

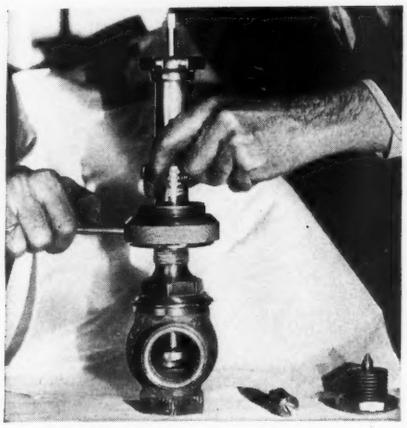
Instruments



Line of detachable instruments needing no panel. Socket into which the detachable instrument plugs can be installed in all circuits feeding electrical loads where it would be helpful to note the consumption and performance characteristics, even if only occasionally. Advantages claimed: socket provides its own switchboard; various instruments can be plugged into the same socket to obtain readings in volts, amperes, watts, etc.; sockets can be installed and sealed off providing convenient outlets for future installation of instruments or making connections for portable

analyzers. Consist of two main units: first a socket or mounting device which is provided with electrical connection jaws and, second, the instrument mechanism mounted on a plate having electrical connection blades on the back and inclosed in a weatherproof glass housing. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Valve Reseater

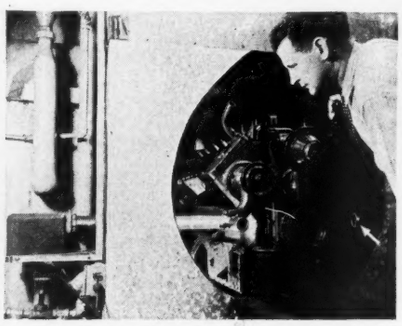


The "Standard Reseater" is a combination tap and cutting tool which removes the old corroded seat and at the same time threads for the inserting of a new removable seat. Made of brass, it can be furnished in sizes from $\frac{13}{16}$ to $1\frac{7}{8}$ in. Standard Reseater Corp., 423 West 126th St., New York.

Goggles

No. 414 molded goggles have adjustable lenses. It is not necessary to take the goggles apart to change length of nosepiece. A slight turn of dial gives exact adjustment. Is said to be exceptionally comfortable because headband can be worn loosely to give even bearing pressure at all points. Special arrangement of ventilation prevents steaming of lenses. Lens diameter is 50 mm. Sellstrom Mfg. Co., 615 North Curtis St., Chicago.

Photoelectric Counter



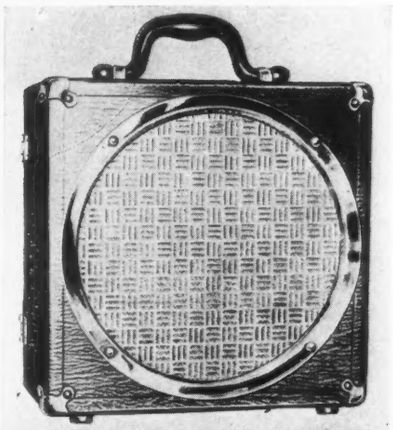
Type 67 photoelectric counting mechanism consists of a fast, accurate counting mechanism operating from the plate circuit of a standard radio tube, coupled to a two-stage, direct-coupled photoelectric cell amplifier with rectifier for supplying d.c. to the tubes and counter coil. There are no intermediate relays and no sparking contacts. Besides the Type 67 photoelectric counting unit, the equipment consists of Type 257 light source and the four or five digit electrically operated counter. Electronic Control Corp., 2332 East Grand Blvd., Detroit.

Adhesive

"Flexogrip" is an adhesive for use in setting up polishing wheels. It requires no thinner and can be applied with a brush to bond grains to the wheels. Type A is for use with grains coarser than No. 80; Type B for grains finer than No. 80 and up to grade FF. The adhesive is said to harden rapidly under heat, and to resist tendency to glaze. Udylite Co., Detroit.

Public Address System

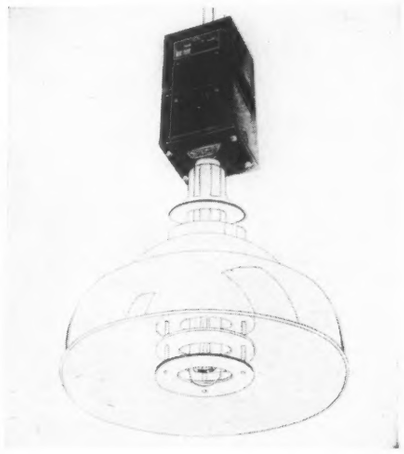
"Soundmaster" is a completely self-contained microphone-amplifier loud speaker system. Two extra inputs are provided for microphone, music pick-up, or phonograph. The audio power output is 12



watts. It is equipped with a 12-in., 15-watt speaker, which gives great carrying power without effect of loudness. Operates directly from 110 volts, 50-60-cycle lines. Converters for battery operation can be furnished. Sundt Engineering Co., 4238 Lincoln Ave., Chicago.

Lighting Transformer

High-intensity mercury vapor lamp transformer is said to provide high performance at high efficiency. Use of oversize wire for all coils is said to help to insure cool operation of functioning units. Coils are of armored insulation type, double impregnated. Has universal mounting, being suitable for either wall, ceiling, or pendant mounting. A thread coupling is an integral part of the end plates. Has two positive-contact universal terminal panels mounted in a large compartment with ample space for making connections. All connections to line or lamp are made at these panels, with no joints or taping required. Connections may be made from either or both ends of transformer for mercury vapor or mazda lamps or for combination use of both type lamps. The Acme Electric & Mfg. Co., 1440 Hamilton Ave., Cleveland.

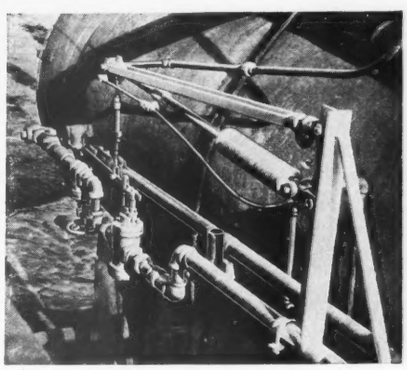


Boiler Feed Pumps

Line of multi-stage centrifugal boiler feed pumps for pressures up to 1,200 lb. per sq. in. Even number of impellers, facing in opposite directions, serve to equalize axial forces and eliminate balancing drums or discs. Large thrust bearings. Staggered volute construction gives radial hydraulic balance. All parts are highly accessible. There are an external interstage loop, a casing shaped to prevent erosion and eddy currents, and heavy-duty, oil-lubricated ball bearings mounted in dirtproof housings. Horizontally split casing with suction and discharge nozzles in lower half. Made in 4-, 6-, and 8-in. sizes for speed range 2,500–4,000 r.p.m. Capacities range from 200 to 1,500 gal. per min. Worthington Pump & Machinery Corp., Harrison, N. J.

Feed Water Control

Campbell-Cantilever Boiler Feed-Water Level Controller maintains water level within $\frac{1}{2}$ in. Is made in one size to meet all boiler needs. and will operate any valve up to 12 in. Its over-all length is 48 in., and it can be operated with or without a



whistle. It is installed on side of the boiler and is easily accessible. Frame is set so that water level mark is at same level as desired water level in the column. When water level drops in gage glass, water runs

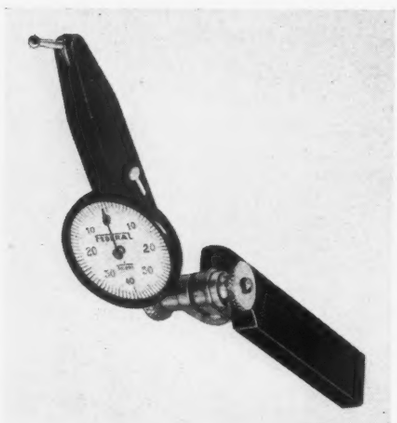
down an inclined tube exposing same to high temperature of steam at boiler pressure. This instantly causes rapid expansion, which is multiplied eight times due to the triangular construction. This causes the end casting to move upward, opening the valve an amount equal to eight times the extent of the expansion. As water rises in the gage, cooling action of the water rising in the tube causes contraction which lowers the end casting and closes the valve. Action is wholly automatic. J. A. Campbell Co., Box 851, Long Beach, Calif.

Flexible-Shaft Grinder

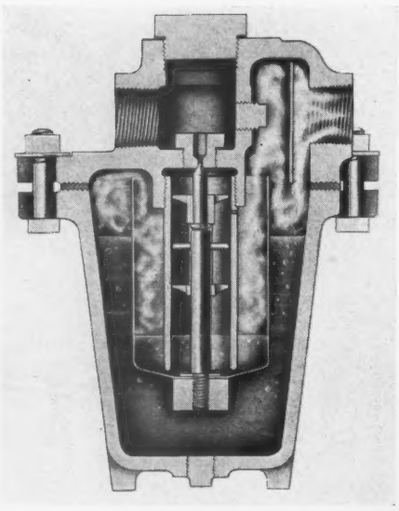
Universal flexible-shaft grinder is rated at 1½ hp. and operates at 9,000 r.p.m. on either 110 or 220 volts, a.c. and d.c. It is intended for grinding weld seams, flat surfaces, surfacing and snagging castings, grinding stainless steel. Mall Tool Co., 7740 South Chicago Ave., Chicago.

Test Indicator

Model 2 is a light, compact, and accurate indicator. It is graduated to read 0.0001 in. It can be used in surface and height gages, toolposts, and special fix-



tures. By shifting a reversing lever, motion of the point can be reversed. Has a low-friction jeweled movement. Is furnished with a universal holding bar and clamp in a compact case. Its range is 0.008 in. The dial reads 0-40-0 and is 1⅛ in. in outside diameter. Federal Products Corp., 1144 Eddy St., Providence, R. I.

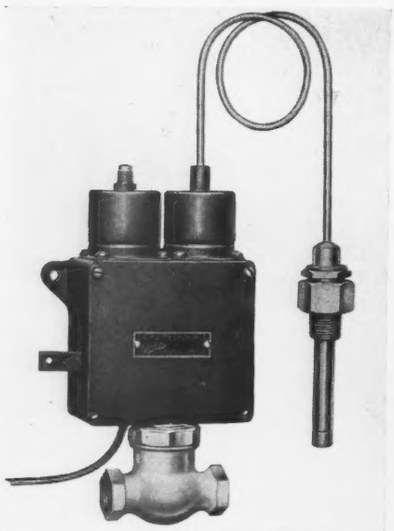


Steam Trap

Bucket type steam trap is designed for straight line installation, making possible inspection and cleaning without disturbing pipe connections. Plug at top gives easy access to the seat. Bucket and seat are only moving parts. It is claimed that wire drawing is prevented by the quick, positive action. Positive water seal prevents blowing steam. Applicable for condensate drainage up to 150 lb. Cochrane Corp., 3124 North 17th St., Philadelphia.

Diesel Safety Control

No. 530 diesel engine safety control provides protection against high jacket-water temperature and low lubricating-oil pressure. If temperature goes too high or oil pressure goes below safe point, fuel oil supplied to engine is immediately shut off. Should oil pressure control or thermostat



cease operating, the engine will be stopped. There are no stuffing boxes and the instrument is said to be vibration-proof. External lever provides manual operation in starting. Thermostat portion of the instrument can be furnished with temperature range of 125-175 deg. F., or 180-210 deg. F. Pressure element may be adjusted to trip within a range of 5-25 lb. All mechanism is inclosed in a cast brass box with mounting lugs integral. It is to be mounted on engine in a convenient location. Fulton Sylphon Co., Knoxville, Tenn.

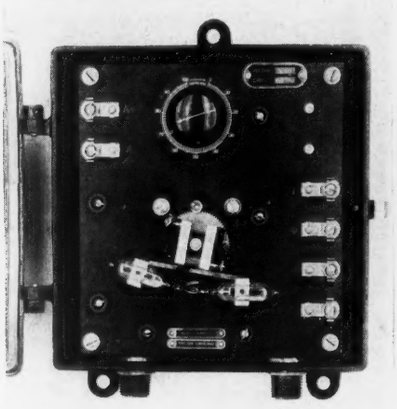
Production Control Machine

Two models of the "Chronolog," a production control instrument. Model M indicates clock time, units produced, reasons for delays, and prints this information on a paper chart or card, or both. Printing is controlled by manual operation of pushbutton, or automatically every 10 minutes. Time mechanism is operated by a synchronous motor. Instrument is supposed to be located at the work point, and as well as being used as a production control device it can be used as a time clock. Model O is intended primarily for use as a recording counter. It prints the

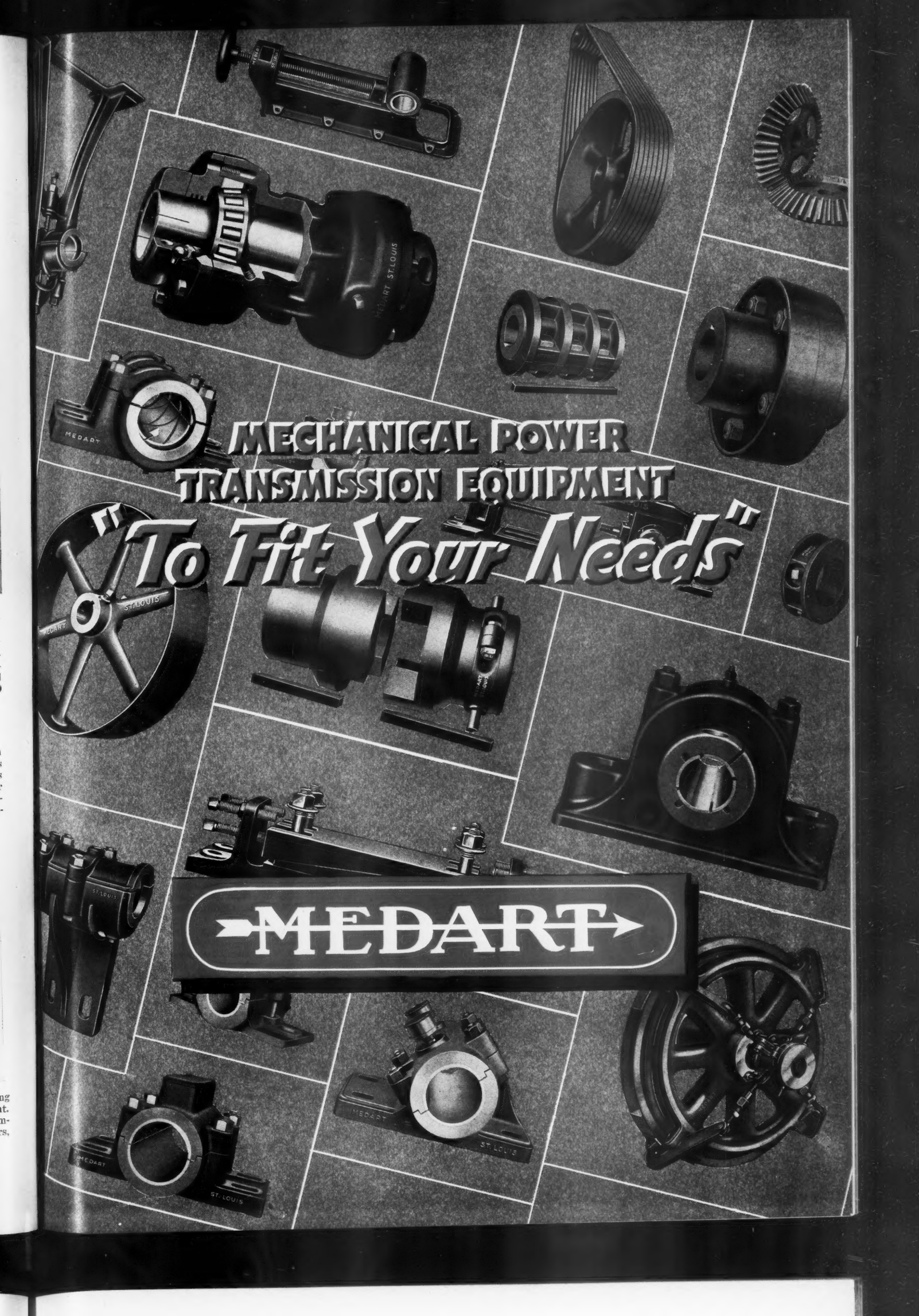
standing of the register wheels on a chart or card, the printing mechanism being controlled by manual operation or automatic printing every 10 minutes. It may also be used for accumulating idle or production time with the digit wheels registering tenths of minutes of time instead of units. The National Acme Co., 170 East 131st St., Cleveland.

Pyrometer Controllers

The "B-Linator" is a device for use with automatic pyrometer controllers such as used on heating furnaces. Purpose of this device is to enable the pyrometer controller to anticipate temperature changes and correct fuel consumption long enough in ad-



vance to prevent temperature from rising above and falling below the control point. Can be used with practically all of the commonly used types of pyrometer controllers,


MECHANICAL POWER
TRANSMISSION EQUIPMENT
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and can be added to present installations as well as incorporated in control circuit of new equipment. Through a switching device it adds or subtracts an emf. to the regular thermocouple circuit to cause controller to act. Auxiliary emf. is derived from thermocouples in the "B-Linator" case connected in series but opposing each other. Magnitude of emf. produced by these thermocouples is dependent on the temperature change trends. The Bristol Co., Waterbury, Conn.

Truck

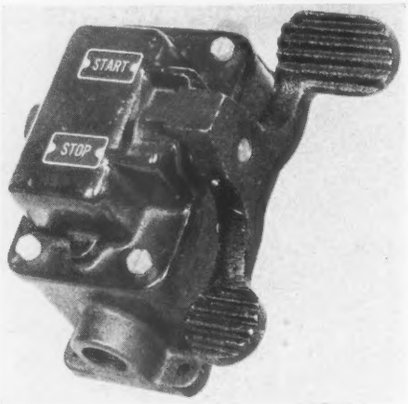
Clark Tote Pan Truck is of tubular steel construction, electrically welded throughout, with two vertical straps against which the pan or pans rest. It has a capacity of 1,000 lb. The extended arms fit under the pan flanges, enabling operator to pick up pans singly or nested. Is available for all standard sizes of tote pans. Has two 6-inch-diameter semi-steel or rubber-tired wheels. All Steel Welded Truck Corp., Rockford, Ill.

Thermometer

"Any Angle" dial thermometer has a dial that can be quickly tilted to the angle of greatest visibility. It is easily read and is accurate. Its bulb will fit the socket used for a glass thermometer. May be installed without shutdown of equipment. Is of rugged construction, entirely of steel, with all joints welded. Consolidated Ashcroft Hancock Co., Inc., Bridgeport, Conn.

Pushbutton Station

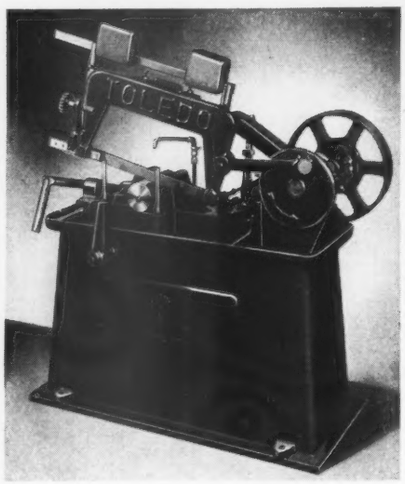
Type CR2940-2A1S treadle-operated watertight pushbutton station is designed for installations where an operator must have both hands free while starting or stopping his machine. Is also especially suitable for use in damp or wet locations. The station is available either with single- or double-action treadle. Inclosing parts, case and cover, are made of cast iron, and



cast iron foot pedal or treadle is built into the cover. This pedal operates a standard heavy duty pushbutton unit mounted inside the case and is provided with stops to limit its travel in either direction. The shaft is provided with a spring which guarantees automatic return of pedal to the neutral position. Case is arranged for conduit connections on either end and is so built that it can be mounted directly on the floor. Conduit connections will accommodate standard $\frac{3}{4}$-in. pipe. General Electric Co., Schenectady, N. Y.

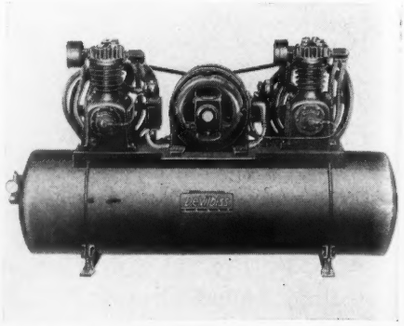
Power Hacksaw

High-speed power hacksaw of 6x6-in. capacity. Uses 10- to 14-in. blades and provides automatic saw release on the non-cutting stroke. Automatic trip stops machine at end of the cut. Coolant pump is mounted in the base. L-W Chuck Co., Toledo, Ohio.



Air Compressor

Four air compressing units are available in $7\frac{1}{2}$ or 10 hp. with single- or two-stage compressors available with either horsepower. Two compressors, each developing a maximum pressure of 200 lb. with two stages or 150 lb. with the single stage, are firmly mounted on opposite ends of the



20 x 60-in. air tank. Driving motor is set between the two compressors on the air tank. Each compressor has a V-belt drive, combination air strainer and muffler, check valve, inter and after cooler, and centrifugal pressure release mechanism set to cut in at 160 lb. and cut out at 200 lb. on the two-stage, in at 80 lb. and out at 100 lb. on single-stage. Displacement of outfits varies from $31\frac{1}{2}$ to 57 cu.ft. of free air per min. The DeVilbiss Co., Toledo, Ohio.

Paint Bonding Process

Produces smoothly etched surface to form base for paint or enamel. Since it is insoluble in water, the coating stops moisture that may penetrate the paint film. It is said to provide a grip for the paint that will prevent flaking and peeling. Bonding Process Corp., Detroit.

Door Opener

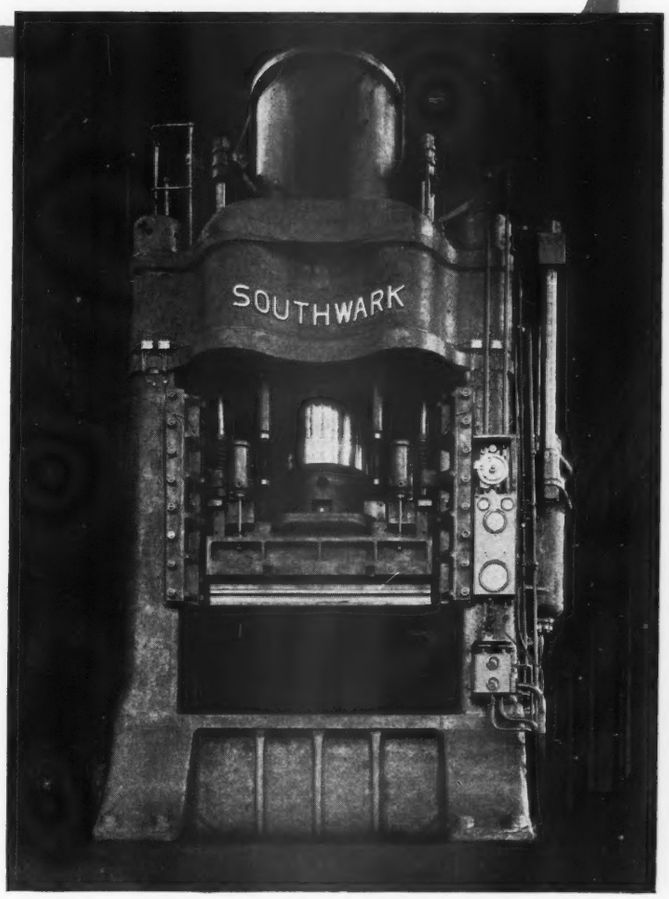
One-man car door opener and closer is designed to prevent injuries likely to occur in this operation. Consists of a tough steel chain to which a hook is attached at one end and a hook and ratchet pulley at the other. The hook at the pulley end is

fastened to the door handle and the other hook is attached to some object at end of the car. Operator pulls the chain taut through the ratchet pulley and applies a downward pressure to the middle of the chain. This produces a pull on the door far in excess of what could be exerted by several men pulling directly. As the door slides, causing a slack in the chain, the slack is taken up by means of the pulley, and the operation is repeated until the door is wide open. To close the door the operation is reversed, with the chain changed end for end. The chain, which is of twist link type, is welded throughout, as is hand ring at the end. Signode Steel Strapping Co., 2600 North Western Ave., Chicago.

Solder

"Alumi Solder" is a solder intended for jointing aluminum pieces. It can be applied with iron or blowtorch. Both solder and flux are combined in a stick or wire, so only preparation necessary is cleaning of the surfaces. L. B. Allen Co., Bryn Mawr Ave., Chicago.

A *Battle* WAS LOST FOR WANT OF A *Nail*



The old story of the missing horseshoe and the lost battle has its counterpart in modern industry. Even so comparatively small a thing as a single bearing can burn out for lack of adequate lubrication—throwing its own machine, and sometimes even a whole department, completely out of commission.

The net worth of production time lost each year to industry through faulty lubrication can only be estimated but certainly it totals a staggering sum. In one large plant, accurate records reveal that **80%** of *all* lost production was due to lack of lubrication.

Farval Centralized Systems will protect your machine operations at all times against costly delay due to improper lubrication.

Farval is a mechanical method of delivering clean lubricant from a central station under high pressure to a group of bearings, in exact, measured quantities. Operation is constant and positive, *and not a bearing is missed.*

An experienced Farval Engineer will show how the Farval System will effect immediate, continuing savings for you. The Farval Corporation, 3256 East 80th Street, Cleveland, Ohio.

Affiliate of The Cleveland Worm & Gear Co., Manufacturers of Automotive and Industrial Worm Gearing

FARVAL

CENTRALIZED SYSTEMS OF LUBRICATION

Special Delivery to Every Bearing

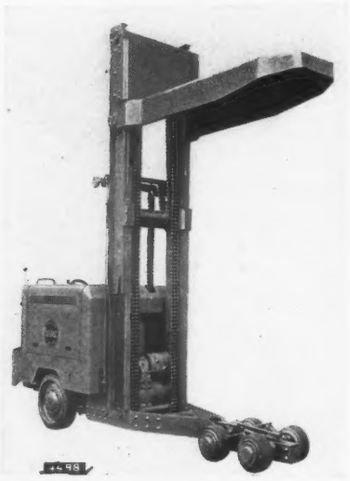
Drill Presses

Line of 17-in. drill presses can be used in the general machine shop, tool room, or in production. Overall dimensions are: 66 in. high, 18 in. wide, 27 in. front to rear. Floor base has a 10 x 13¾-in. table surface. Bench-type base is available with a 20 x 20-in. table surface and an oil trough all around. For the floor-type model, either an 11 x 12-in. tilting table or a 12½ x 17-in. table is available. Column is 3½ in. in diameter, of heavy walled tubing, ground and polished. Maximum capacity is ¾-in. cast iron. Spindle pulley has five speeds: 385, 600, 935, 1,450 and 2,240 r.p.m. It is carried in self-sealed ball bearings. Pulley is of floating type, in which none of belt pull is transmitted to the spindle. Delta Mfg. Co., 600 East Vienna Ave., Milwaukee.

Watercoolers

Three pressure- and one bottle-type watercoolers. Cabinet bodies are constructed of rust-resisting furniture steel finished in green or brown. Top and base are built of cast gray iron finished in green or brown enamel. Chromium-plated brass bubblers are self-cleaning and equipped with pressure-regulating valve. Models PG-627 and PG-1357 have chromium-plated brass glass filler with control and flow adjustment. Model PG-1357 has basic cooling capacity of 13.5 gal. per hr., with a 2-gal. storage capacity. Model PG-627 has cooling capacity of 6.2 gal. per hr., storage capacity of 2 gal. Model PG-487 has cooling capacity of 4.8 gal. per hr., with ¾-gal. storage capacity. Water temperature is controlled thermostatically and eleven temperature positions are available. Bottle type coolers are designed for use where water supply and drain connections are not available. Equipment includes a 3-qt. waste receptacle fitted with rubber bumper easily lifted off and replaced. They have cooling capacity of 4.7 gal. per hr., with a ¾-gal. storage tank. Norge Division Borg-Warner Corp., Detroit.

Truck



Type HH-5 Hy-Lift truck has capacity of 5 tons. This truck permits tiering skids to extreme heights while retaining a nested height low enough to enter a standard box car. Nested height is 88 in., maximum lift of platform 106 in. above the floor. Platform dimensions are 26½ x 54 in. Hoisting is done by two double, alloy steel roller chains. Trailer axle is of tandem type which is articulated, and fully compensating in both longitudinal and transverse directions. Hoist controller operates through a magnetic blowout, mill-type contactor. Controller is connected to hoisting mechanism in such a manner that it is automatically returned to neutral at upper and lower limits of platform travel. The Baker-Raulang Co., 2178 West 25th St., Cleveland.

Pushbutton Station

Type CT2940-2HK1 pushbutton station has a "mushroom" head. This is an oversize head on the stop button, which makes it possible to slap the button with the open hand and operate the switch to shut down a machine. The molded stop button to which the mushroom head is fitted is approximately ½ in. longer than the stop button on standard equipment. The head is screwed to a metal insert on the end of the button. General Electric Co., Schenectady, N. Y.

Oil Can

"Filter-Right" oil can has been designed to protect expensive machinery by filtering all oil dispensed into lubricators. As oil is poured into can, it enters cloth filtering bag which collects all grit, dirt, and other impurities. The filter bag may be removed, cleaned, and replaced when it becomes dirty. The dispensing spout is equipped with a heavy spring lid which opens automatically as can is tipped. Comes in 2- and 3-gal. sizes. Two weaves of filtering bags are available, one for heavy, one for light oil. Justrite Mfg. Co., 2061 Southport Ave., Chicago.

Sawing Machine

"Metalmaster" is a continuous sawing machine which can carry out machining operations usually performed by shaping, milling, lathe work, or torch cutting. It can remove material, be used for slitting, and it can do machining by reason of the intricate clean shapes it can cut. It cuts material such as high speed steels, tool steel, brass, copper, aluminum, various alloys and non-metallics. By use of a butt welder quick saw end joinings may be accomplished. Saw speed range of

YOU WILL BE BETTER SATISFIED

WAGNER has furnished motors for industrial equipment for many years and has continuously improved motors for this purpose. Among the outstanding features of Wagner motors are: (1) QUIET OPERATION, (2) special operating characteristics to meet this exacting service, (3) long life, and (4) attractive appearance.

WHEN YOU INSTALL

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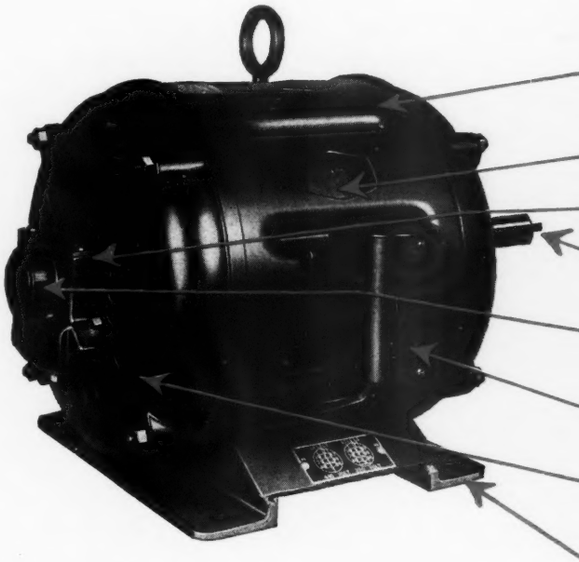
POLYPHASE MOTORS

THEY MEET YOUR REQUIREMENTS OF PERFORMANCE AND DEPENDABILITY



A FEW OF THE POINTS OF SUPERIORITY OF WAGNER SQUIRREL-CAGE MOTORS ARE:

FRAME is fabricated from heavy steel-plate rolled into cylindrical shape and welded.

AIR-OUTLETS are extra large for unrestricted ventilation.

OIL-WELL HOUSINGS are sealed against the entrance of dirt and grit, and the escape of oil.

SHAFT is designed to carry mechanical overloads.

BEARING is steel-backed, babbitt-lined. Wagner also furnishes ball or roller bearings.

CONDUIT-BOX is mountable in four positions.

END-PLATES are liberally designed, heavy and massive, amply strong and rigid, to withstand severe service conditions.

FEET are of steel, welded to the stator-frame—accurately spaced according to Wagner dimensional diagram sheets.

Many other features of Wagner motors are worth investigating. Write today for Bulletin 182

The Wagner line includes all types of motors generally applied on industrial equipment, making it possible for you to completely equip your plant with Wagner motors. Whether alternating or direct current; single or polyphase; open, drip-proof, or totally-enclosed; rigid or resilient-mounted—there's a Wagner motor now in existence, ready to be applied on the job.

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

MOTORS • TRANSFORMERS • FANS • BRAKES

BL 337-30

50-800 ft. per min. can be had. Tachometer with speedometer-type dial indicates exact speed at which machine is operating. Table tilts four ways: 45 deg. forward, 10 deg. back, and 10 deg. laterally. Built in two sizes, one with 14-in. throat, other with 30-in. throat. Has job selector dial providing exact data on saw speeds and saw specifications for 48 materials. Continental Machine Specialties, Inc., Minneapolis.

Motor

Type CP totally inclosed fan-cooled motor can be operated in atmospheres heavily laden with abrasive dusts, deteriorating metals and salts, explosive dusts, corrosive gases, and extreme dampness. Motor has skeleton-type stator, deeply grooved on the outside to increase radiation. An external blower is mounted on the front end, which directs cooling air around the front endplate and over the corrugated surfaces through a baffled back endplate down over the bearing. Ball bearings are all of the cartridge type. Core of the motors is in the center of the frame to permit reversing of endplates and rotor in order to reverse location of conduit box. Feet are electrically welded to the frame and are made of steel. Wagner Electric Corp., 6400 Plymouth Ave., St. Louis.

Lift Truck

"Red Giant Lift Truck" is hydraulically operated, the operator pumping in full strokes, or shorter, from any angle. There is an automatic shutoff when the platform reaches full height, and release of load is accomplished with automatic foot lever, which is adjustable. Comes in both narrow- and wide-frame types. Three-inch lift is standard, but it may be had in 4-, 5-, and 6-in. lifts, and greater. Standard capacities range 2,500-15,000 lb. Revolvator Co., State St., at Bergen Turnpike, North Bergen, N. J.

Drawing Paper

Has two invisible patterns, similar to single and double crosshatching incorporated in its surface. After outlines have been made on the paper, two developers are used to bring out the crosshatching where desired; one developer brings out the single pattern, the other the double. Available in three patterns having 42, 65, and 80 lines-to-the-inch screens. The Craftint Mfg. Co., Cleveland.

Storage Rack

Consists of heavy wire mesh so woven as to expose an absolute flush working surface for stock handling. Gives complete ventilation, prevents warping or moisture accumulation, allows no dust or dirt accumulation, allows maximum sprinkler system operation, and permits filtering of light through complete structure. Shelves are adjustable to any position. Center post construction allows access to material from any direction. Built to fit requirements. Equipped for stationary, portable, or monorail installation. Called "Superior Ventilated Rack." Superior Wire & Iron Products, 1050 East 76th St., Chicago.

Compressors

Line of compressors in ¼- and ½-hp. sizes. Automatic start and stop control, seamless steel tank. When furnished for single-phase current they are equipped with a brushless capacitor-type motor and a built-in automatic protection switch giving overload and under-voltage protection. Rated for 150 lb. per sq. in. maximum pressure, but may be set for lower pressures, or may be equipped with a reducing valve for still lower pressures. Both sizes are available on a 2.4 cu. ft. tank. The ½-hp. size is also available on a 4.6 cu. ft. tank, either vertical or horizontal mounting. Ingersoll-Rand, 11 Broadway, New York.

Funnel

Drum-filling funnel has strong steel legs riveted to sides which clamp tightly to chime of the drum. The funnel cannot tip; it is held steady and will prevent spilling and slopping of material being poured. Spout is of heavy seamless brass and is riveted to the body of the funnel. George D. Ellis & Sons, Inc., 231 Vine St., Philadelphia.

Welder

Model Forty a.c. welder operates on 220 or 440 volts, and delivers an amperage range of 25 to 225 with 3/32- to ¼-in. electrodes. Mounted on rubber-tired wheels for easy handling. Stands 38 in. overall, is 18 in. wide and 18 in. deep. Equipment includes 25-ft. welding cable and electrode holder, 20 ft. of ground cable with ground clamp, and helmet. Model Fifty is similar, but delivers over 325 amp. with a 5/16-in. electrode. Glenn-Roberts Co., 1009 Fruitvale Ave., Oakland, Calif.

Wire Rope Sling

General utility sling is designed for handling of loads of varying size, shape, and weight. Capacity, 7,000 lb. Body of this "Siler Sling" is made of ⅜-in. 6x19 wire rope fitted with a double hook assembly. Body rope is said to be easily replaced. Comes in one size, complete with rope attached and with auxiliary grapple hook. Macwhyte Co., Kenosha, Wis.

Washer Punch

Washer punch cuts washers out of metal, fabric, gasket material, fiber, steam packing, strawboard, asbestos, leather, felt, cork, rubber and any other similar material up to 1/16 in. in thickness. It has 18 hardened dies with which it is possible to obtain 150 different washer sizes. Dies are mounted in an eccentric turret plate.

ALL INDUSTRY COUPLES HOSE QUALITY WITH THIS FAMOUS BRAND NAME . . .

Thermoid
INDUSTRIAL RUBBER PRODUCTS
BUILT FOR THE JOB
QUALITY VALUE SERVICE

Is it hose you need? That's easy. Your supply house can suggest the ideal product to fit your needs from among the seventy-five distinct types bearing the Thermoid brand. Constant demand for many Thermoid products means that many of these types are stocked locally and ready for prompt delivery. For example, here are a few of the types in most constant demand:

Air Hose
Steam Hose
Water Hose
Suction Hose
Fire Hose
Spray Hose
Creamery Hose
Welding Hose
Sand Blast Hose
Brewer's Hose
Chemical Hose

You'll get *quick* service by specifying Thermoid Hose. You'll get *long,* satisfactory service from using it. When unusual conditions suggest a specially constructed hose, why not put your problem up to us at "Hose Headquarters"?

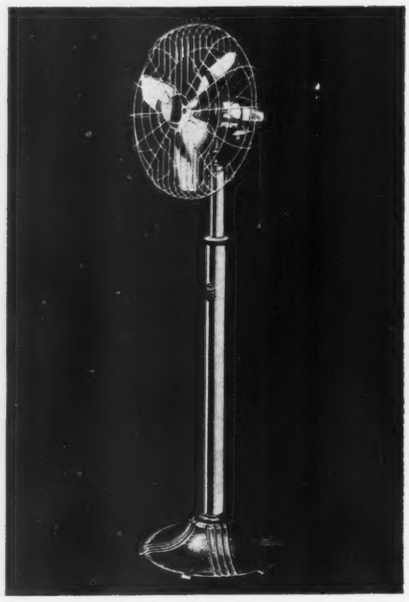
THERMOID RUBBER
Division of Thermoid Company
TRENTON · NEW JERSEY

Thermoid

HOSE · BELTING · PACKINGS · BRAKE LININGS

thereby placing them all as close to the edge as possible and making it more convenient to center and withdraw the washers from the machine. The centering system incorporated insures concentric punching. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Fans



Oscillating air circulator fans of 24-in. size give high-velocity and large-volume air circulation. They have resilient mountings for quiet, vibrationless operation. Available in tall pedestal and wall bracket models, they are adjustable to arcs of 0, 30, 60, and 90 deg. Finished in chromium plate with black fittings, polished aluminum blades. Diehl Mfg. Co., Elizabethport, N. J.

Pumps

Design of Nos. 101, 102, and 103 Rotary Geared Motorpumps has been changed so that these pumps are not made to run in one direction only, either right-hand or

left-hand. The hand is determined by the side of the pump on which the discharge is located when viewed from the motor end. With a right-hand pump the discharge will be on the right-hand side, with a left-hand pump on the left-hand side. Direction of discharge is indicated by an arrow on the cap of the pump. A mechanical seal is used. The motor pumps are now available with 3-phase motors, both in 220 and 440 volts, 60 cycles. Similarly, the No. 204 Centrifugal Motorpump is now furnished with 3-phase, 50-cycle, 220-volt motor, 1425 r.p.m. Brown & Sharpe Mfg. Co., Providence, R. I.

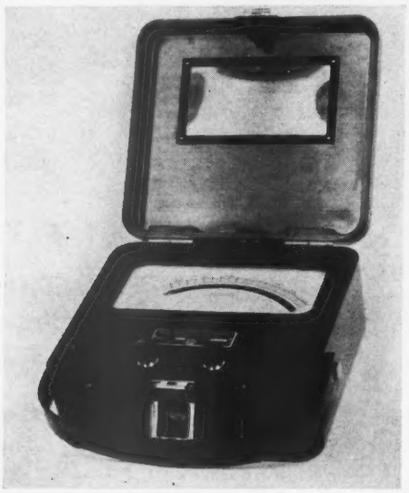
Lamp Fixture

Mercury vapor or incandescent lamp fixture has two-piece reflector body, permitting easy lamp replacement. Cover glass permanently seals the reflector mouth. Unit permits use of either one 750-

1,500-watt incandescent lamp or one 400-watt mercury vapor lamp. Two types: concentrating, for the lighting of high narrow bays; spread type, for use at lower mounting heights where more light is desirable on the vertical surface. Aluminum reflector with radiating fin type aluminum neck which is threaded to engage cast aluminum canopy. Canopies available in pendant or outlet box types. Pendant canopies are tapped ½-in. standard, ¾-in. if specified. Outlet box canopies fit standard 4-in. outlet boxes. Reflector is painted outside; reflecting surfaces are aluminum. Wheeler Reflector Co., 275 Congress St., Boston.

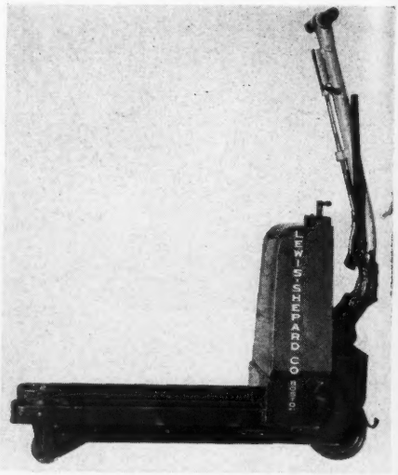
Pyrometer

Millivoltmeter-type portable indicating pyrometer measures temperatures up to



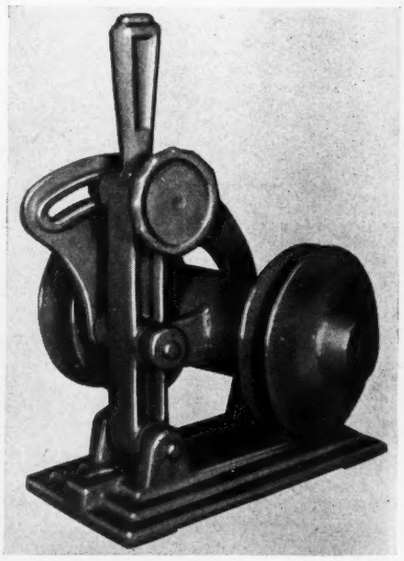
3,000 deg. F., using a thermocouple and extension leads. It is claimed that unusual sensitivity is accomplished without the need for critical leveling adjustments and with no sacrifice of ruggedness. Millivoltmeter movement is double pivoted and completely shielded. Molded plastic case is moisture- and dust-proof. Available in single and double ranges. The Bristol Co., Waterbury, Conn.

Lift Truck



Hydraulic tin-plate lift truck has brakes on front wheels, new type release-valve mechanism, newly designed frame for greater strength, double-seal ball bearings that come grease packed good for a life time. It has a 3-in. lift, with release at any height of lift. There is a 2½-in. clearance under the frame. Load may be locked at any height. There is a spring handle hold-up. Capacity is 2,500 to 5,000 lb. Lewis-Shepard Co., 125 Walnut St., Watertown Station, Boston.

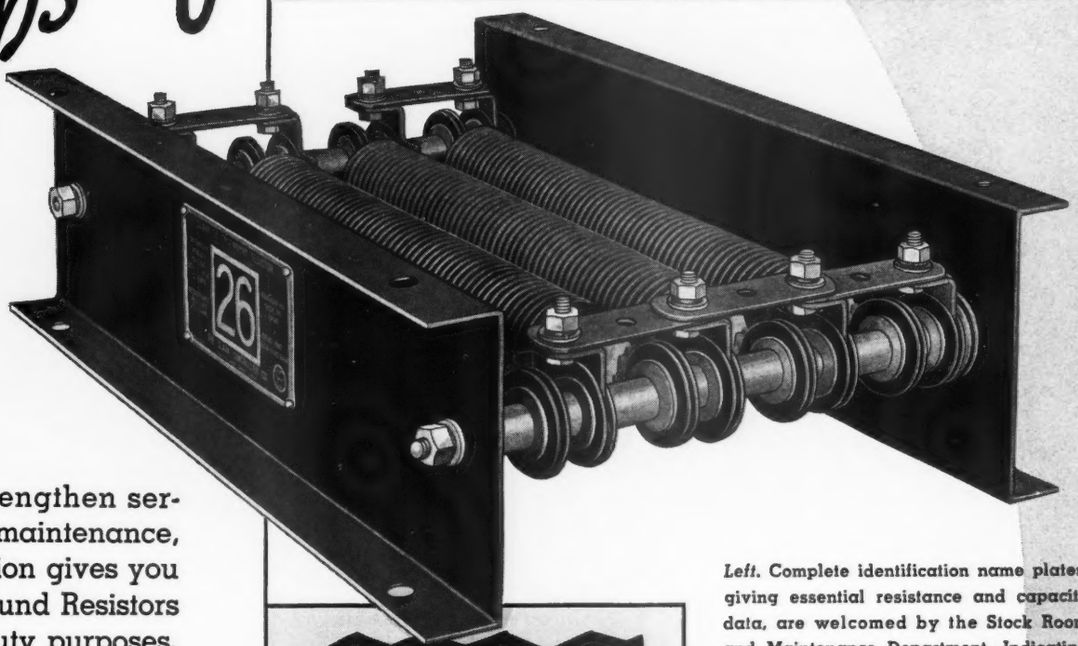
Variable Speed Transmission



"HI-EFF" Vari-Speed Control" consists of a single shaft in which are two adjustable V-belt pulleys which vary in diameter as their distances from the driving and driven pulleys are changed. Offers infinite speed selectivity within ratios of 5 to 1. Offered in sizes ¼–7½ hp. Columbia Vari-Speed Co., Wheaton, Ill.

"Taps" for Taps!

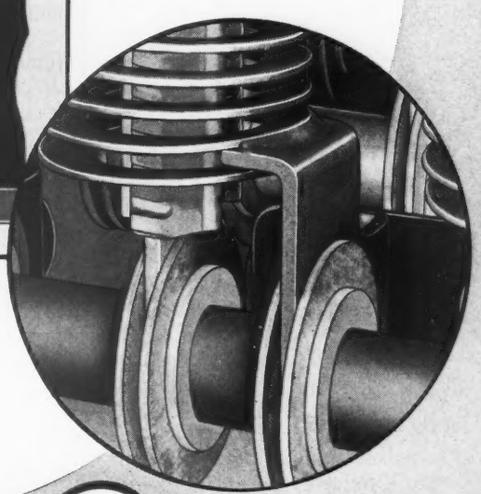
..AND OTHER CHORES



Clark "3C" Mill Bank Edgewound Resistors are furnished in banks of standard capacities. Welded terminals are supplied at both ends of each individual unit. Intermediate taps are practically eliminated.

DETERMINED to lengthen service and lower maintenance, the Clark organization gives you Clark "3C" Edgewound Resistors for severe heavy duty purposes. • ADVANCE copper nickel alloy resistor material, cold wound on edge in cage form, not only successfully withstands shocks and vibration, but also shields porcelain insulators. • Light weight, stalwart steel channels permit the building of compact banks, yet provide full allowance for accessibility and heat-dispelling areas. • Flexibility in dimensions makes possible installation in limited space. • You're always right when you adopt Clark "3C" Mill Bank Edgewound Resistors.

Left. Complete identification name plates, giving essential resistance and capacity data, are welcomed by the Stock Room and Maintenance Department. Indicating numbering or lettering systems with large, legible figures are available to suit the customer's nomenclature or code.



Right. Welded terminals that stand up under expansion, contraction and vibration give positive, constant contacts.

★ ★ ★ ★

BALTIMORE • BIRMINGHAM • BOSTON • BUFFALO
CHATTANOOGA • CHICAGO • CINCINNATI
CLEVELAND • DALLAS • DENVER • DETROIT
LOS ANGELES • MINNEAPOLIS • NEW ORLEANS
NEW YORK • PITTSBURGH • PHILADELPHIA
ST. LOUIS • SAN FRANCISCO • SEATTLE • TORONTO

THE CLARK CONTROLLER COMPANY

1146 EAST 152ND STREET • CLEVELAND, OHIO

Operating Shorts

Use of Cover Sheets Saves Time on Drawing Revisions

FREDERIC OAKHILL, *Plant Engineer*
Bauer & Black, Chicago

Our building and utility drawings, all to ¼-in. scale, presented a problem both as to the amount of original drawing and revision time spent to keep records up to date.

We decided to use the scheme of making cover sheets for all utility drawings. The cover sheet, done in black ink, contains only that data pertaining to the utility or auxiliary details added to the building. The master sheet, done in red ink, contains all the building details. Combination of these two sheets gives the complete drawing. On the blueprint, the building features appear lighter than the utilities which stand out. This is due to the use of the red and black inks.

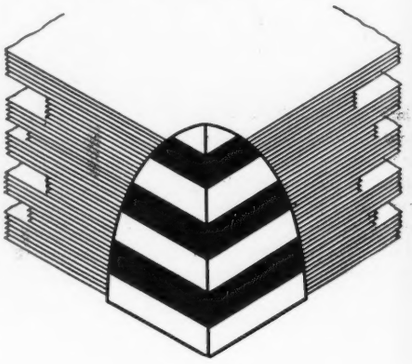
The time-saving feature is that but one set of building drawings needs to be maintained, for any changes to the building affect only this set of drawings. In the same manner, any changes to utilities affect only the cover sheet or sheets showing the particular utility in question.

Mr. Wilkins' contribution has been awarded the $10 *payment offered by the editors for the best Operating Short submitted during the past month.*

Guard for Stacked Sheet Metal Prevents Accidents

GORDON W. RICHARDS, *Orange, N. J.*

In places where sheet metal is stacked, a protective guard has been found to eliminate accidents. This guard, a corner plate, protects workers from the sharp edges of stock piled on the floor. Made of heavy-gage metal, the guard is weighted at the bottom and painted in alternating stripes of black and white so as to be highly visible.



Doors that open automatically when a truckman approaches, speed handling. They operate by phototube-controlled pneumatic action.

Machine Shop Lighted by Combination Units

The machine shop of the new radio tube plant of Hygrade Sylvania Corporation at Salem, Mass., has

Motion-Economized Burring Fixture

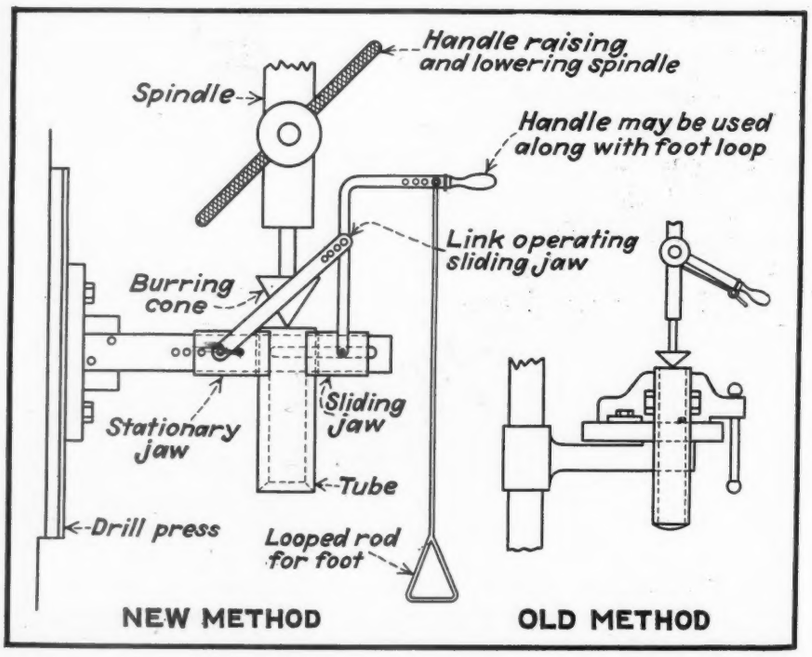
JAMES W. EMMONS
Dexter Folder Company
Pearl River, N. Y.

After cutting off tube lengths, removing burrs from inside of the ends was a lengthy operation, with handling consuming approximately three quarters of the time. The sketches show how the job used to be performed and a new device now in use. Considerable reduction in time has resulted from this arrangement.

Formerly, a tube was placed in a vise on the drillpress table, the vise tightened (the operator using both hands), burring done in the usual manner, the vise unlocked, tube reversed, second end burred, vise opened, tube removed and placed aside.

Using the new apparatus, this same burring operation is done as follows: the job is placed on the left side of the operator, the tube is picked up with the left hand and placed between the jaws while the foot pushes down on the looped rod locking the tube. At the same time the foot reaches the locking position the burring operation can start, the right hand having pulled down the handle operating the spindle.

After one end has been burred, the spindle is raised and the foot pressure is released sufficiently to permit the jaws to open, the tube is removed, reversed, and replaced in the jaws with the left hand, and foot pressure again applied. With this end of the tube burred, the pressure is again released, the tube removed and placed aside.



The GREAT ICE-PLANT MYSTERY

Read how Shell ingenuity helped solve this lubrication problem

THE Mattoon Crystal Ice Company of Mattoon, Illinois, faced a shutdown! The main-shaft bearing driving the ammonia compressor was mysteriously overheating!

Shell went to work with Mattoon engineers. The cause of the trouble was discovered in a worm and gear operating the valve action. Lubrication failure at this point was transmitting heat to the adequately lubricated main-shaft bearing!

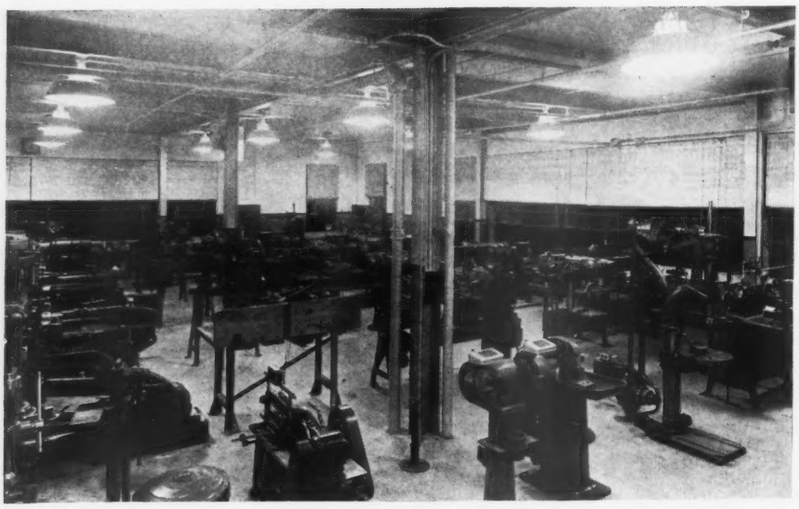
At Shell's recommendation, the Shell Grease particularly suited to this type of lubrication was applied to the worm and gear. Immediately, the main-bearing temperature was reduced to normal! Subsequent examination over a period of two years showed no wear on worm or gear. Today the Mattoon Crystal Ice Company is 100% Shell lubricated . . . and operating at peak efficiency!

Remember this: More than the correct application of the correct lubricant solved Mattoon's problem. The ingenuity and resourcefulness of a great refiner were put to work on this job. This *plus* in lubrication is always ready to solve *your* problems. Call or write your nearest Shell office.

Shell's "Invisible Element" is a combination of Shell's unmatched world-wide resources; Shell's modern laboratories and refineries; years of cumulative experience in research by Shell's engineers and scientists. It is the determination to make lubrication more efficient, more economical for you.

SHELL

SHELL INDUSTRIAL LUBRICANTS



been equipped with combination high-intensity mercury vapor and incandescent lamps delivering an average of 40 foot-candles at the tool points, with a well distributed general illumination remarkably free from shadows and glare. The engineering department of the Hygrade company designed the layout, which covers a shop area 70 x 40 ft. and a ceiling 12 ft. 6 in. high.

The units consist of reflectors housing a 400-watt mercury tube and three 150-watt incandescents, the spacing being 10 x 14 ft. between luminaries. The mounting height is about 11 ft. above the floor. Very little localized lighting is required, but the grinders in the foreground of the illustration are each equipped with two 15-watt lamps mounted under non-breakable glass shields, and connected with the motor control circuits so that whenever the motors are operating the lamps are on. At this grinding wheel surface the intensity is about 125 foot-candles.

•

Special Notice

$10 will be paid for the best Operating Short submitted during the month of August. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

Adjusting Oil-Engine-Driven D. C. Generators

J. DIXON, *Ampere, N. J.*

A nice problem is presented when there is difficulty in securing proper voltage regulation of a d.c. generator driven by an internal combustion engine.

Some engine governors regulate the fuel supply to keep the engine speed constant, regardless of load, up to the maximum output. When the load changes the speed must first change before the governor mechanism adjusts the fuel supply to restore the speed under the changed load.

If the load increases, for example, the speed drops and the governor opens the fuel valve wider. The speed then increases and may even overshoot, causing the governor to reduce the admission of fuel. If the governor is sensitive this performance may be repeated several times, causing what is known as "hunting."

When the series winding of the generator is adjusted to hold up the voltage against the first drop in speed, it is obvious that if the load continues and the speed rises to normal, the generator will produce a higher voltage than it did at the same speed and the original load.

Reducing the compounding to prevent this voltage rise also reduces the ability to hold up voltage on the speed drop. For this reason it is impossible to secure steady voltage with an engine controlled by such a flat-speed governor.

The best that can be done is to adjust the series field experimentally to give satisfactory results. It will usually require the generator to be adjusted for constant terminal voltage, or flat-compounded.

Viewed from the standpoint of the generator, for satisfactory voltage regulation and parallel operation the drive should produce true, constant speed, as does a synchronous motor, or a speed which is at all times proportional to the load, as with an induction motor.

Don't overfuse — remember a fuse is the safety valve in an electrical circuit.

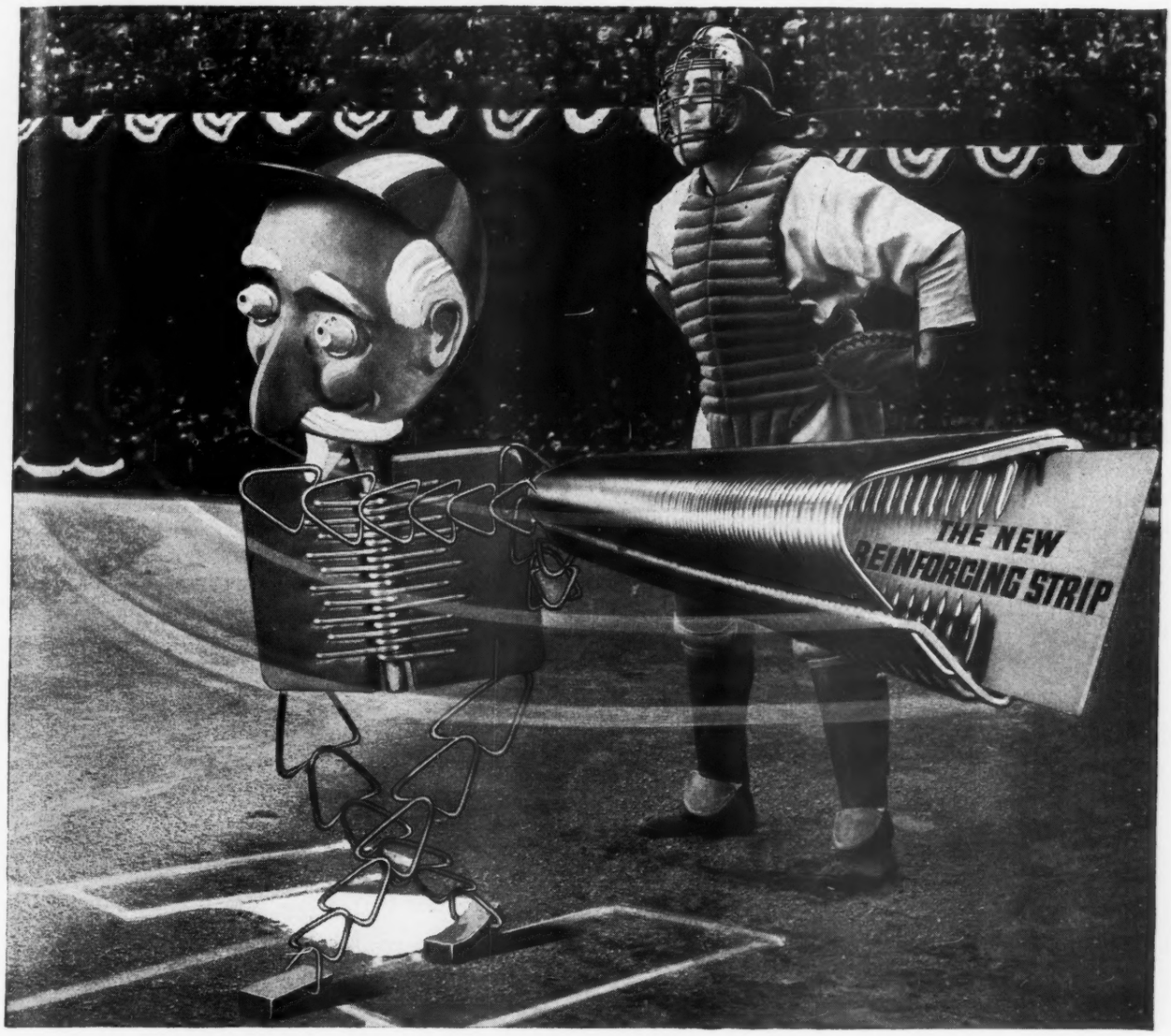
Shipping Papers Are Sent Flying Here

W. C. CUNNINGHAM
Container Corporation of America
Anderson, Ind.

Our problem was to find a method of delivering shipping papers between our shipping office and the general office, located in separate buildings approximately 100 ft. apart. A truck loading yard and a railroad track separated the two so that it was necessary to have considerable clearance above the ground for any conveyor system that might be used. Also, cost of any installation must necessarily be low to show a saving over messenger service, the method previously used.

A Baldwin wire line "Flyer" with a bullet-shaped tube 4 in. in diameter by 14 in. in length did the work successfully.

The car travels a total distance



COLONEL CLIPPER BELTS A WINNER

Belt users! Colonel Clipper comes
To bat with something new
That makes his famous Clipper Hooks
More useful still to you.

It's new! A Reinforcing Strip
Now guards each hook in place
Until it's ready to imbed
And make a perfect lace.

No card of Clipper Hooks can wound
A workman's hand or eye;
And unused hooks are safe from harm
Wherever they may lie.

So take the Colonel's latest tip—
You'll LIKE the Reinforcing Strip.

Clipper Belt Lacers and Belt Lacing Hooks, in all sizes, are stocked by your nearest mill supply jobber.

CLIPPER BELT LACER COMPANY, GRAND RAPIDS, MICH., U. S. A.

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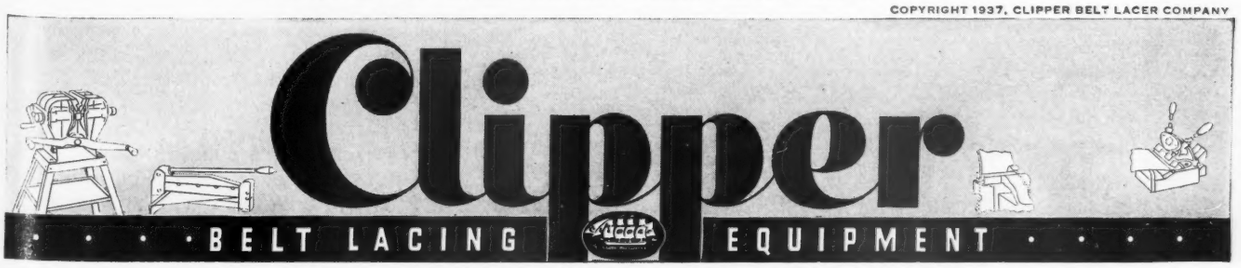

PAGE FENCE

pioneered
and perfected

ARMCO **ARMCO INGOT IRON***
fencing . . .

PAGE made America's first woven wire fence in 1883 and has pioneered most fence improvements ever since.

With no manufacturing obligation to any *one* metal, PAGE is the only fence consistently identified with the greatest names in metals. Page-Armco Ingot Iron fencing was pioneered and perfected to provide unusual resistance to salt spray, chemical fumes and other conditions harmful to even finest copper-bearing galvanized steel. Its cost has been lowered by Page to but little above that of steel. Coupon brings full details.

***ONE OF 5 SUPERIOR FENCE METALS**

PAGE FENCE is offered in 5 superior metals to meet every condition in fencing—Page P-12 Copper-bearing Steel, Page-Armco Ingot Iron, Page-Alcoa Aluminum, Page-Allegheny Stainless Steel and Page genuine Wrought Iron. All Page P-12 galvanized fence—mesh, fittings, top-rail and new P-12 Wing Channel Line Post—is covered by the 12-dip Preece Test guarantee, the highest known to the industry.

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AMERICA'S FIRST WIRE FENCE—SINCE 1883

of about 150 ft. From the main office the car covers approximately 150 ft. out-of-doors to another building at a height approximately 5 ft. above the second story floor level, making a turn inside the building and traveling 150 ft. further to a timekeeper's station in the factory.

The car is propelled by being shot out along the wire by an elastic sling-type propulsion device which is manually operated by simply pulling a cord. There are two of these propulsion devices, one at each end of the line. The highest point in the track wire is set at or near the midpoint so that in case the car should be stopped en route for any reason, it will automatically return by gravity to one of the stations.

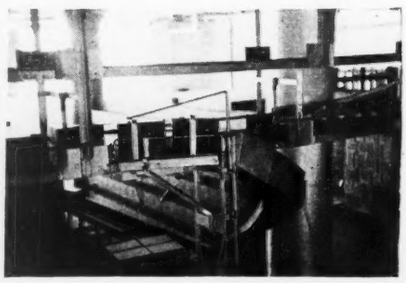
As no power is needed, installation of this equipment is inexpensive and maintenance costs practically nothing.

Toolbox burdens can be reduced by drilling holes in heavy wrenches and other weighty tools at points where holes will not weaken the structure of the tools or interfere with their operation.

Conveyor Takeoff Is Simple and Portable

JOHN I. THOMPSON
Assistant Plant Engineer
Bristol-Myers Company, Hillside, N. J.

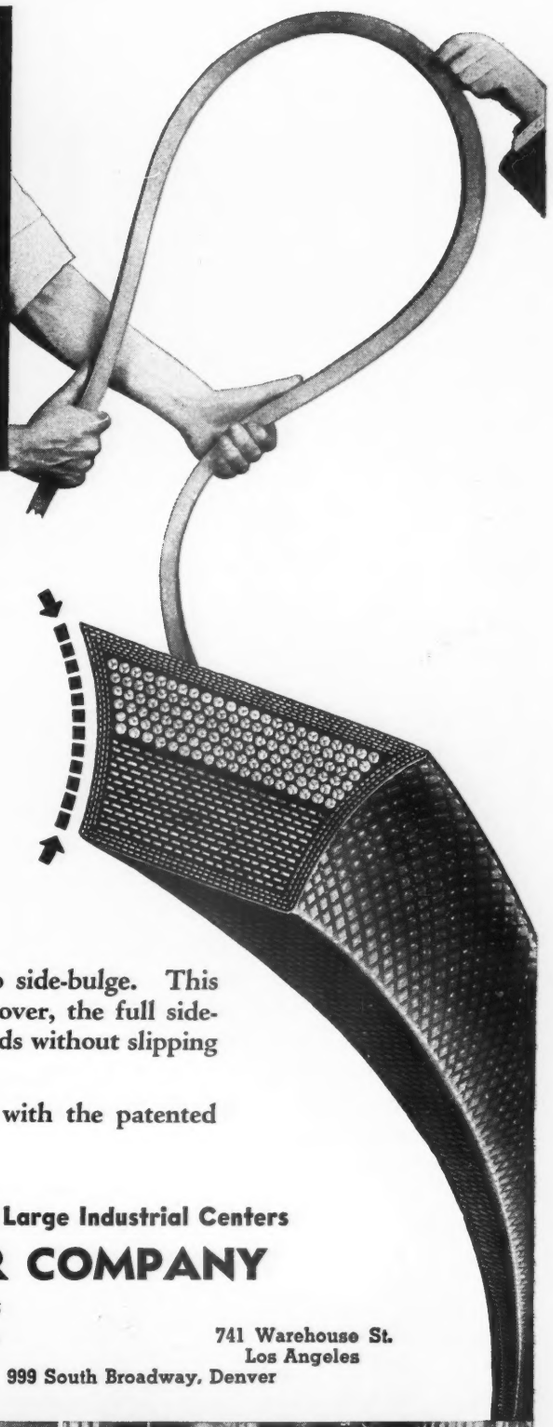
The equipment shown here provides a simple method of taking off packages from a belt conveyor. Its great advantage is its portability, allowing packages to be taken off at



any point along the belt and transferred to roller conveyors which are on a lower level. These roller conveyor sections are portable; hence one reason why the takeoff must be portable.

Construction consists of a welded angle-iron base mounted on swivel casters, and upon which is secured a spiral, sheet metal chute. At the bottom of the chute there is a pin

This Simple Test Shows WHY V-Belts NEED THE CONCAVE SIDE



Bend *any* V-belt and *feel* its top narrow under tension, its bottom widen under compression. You will see that a *straight-sided* V-belt *must* assume in its sheave-groove the shape shown in figure 1, below. Note the out-bulge of the sides!

FIG. 1 FIG. 2

Now try the same test with a Gates Vulco Rope. You will find that the *same shape change* merely *straightens* the precisely engineered concave side (see figure 2). There is no side-bulge. This insures uniform side-wall wear; *longer* life! Moreover, the full side-wall grip on the pulley naturally carries heavier loads without slipping —a saving in belts and also a saving in *power!*

The Gates Vulco Rope is the only V-Belt built with the patented concave side.

Engineering Offices and Stocks in All Large Industrial Centers

THE GATES RUBBER COMPANY

Factory Branches

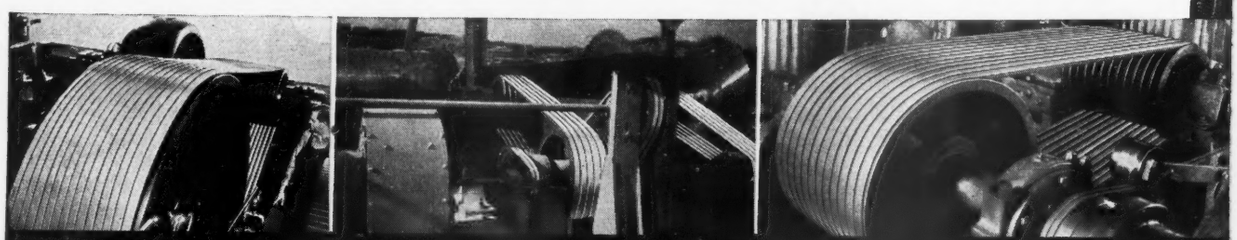
Terminal Building
Hoboken, N. J.

1524 So. Western Ave.
Chicago

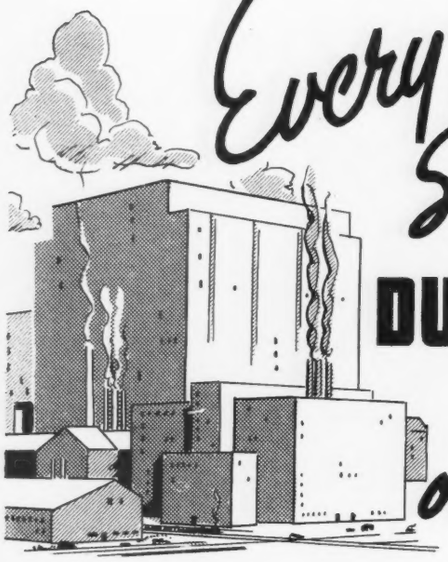
741 Warehouse St.
Los Angeles

2213 Griffin Street, Dallas

999 South Broadway, Denver



GATES VULCO ROPE DRIVES



Every factory is Safer with DUFF-NORTON JACKS on the job!

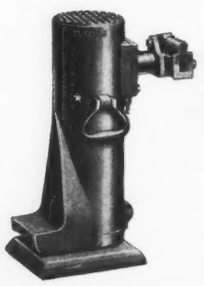
WHEN you put a Duff-Norton Jack under any load, you can depend on it implicitly to shoulder its full measure of responsibility. Back of each jack is the accumulated experience of more than 50 years of specialization in jack design and construction—50 years of progressive development that have made Duff-Norton Jacks the standard of safety the world around.

Extra safeguards are built into every part—powerful hammers literally forge super strength into vital parts—scientific heat treating adds its full measure of safety while the rigid inspections and final test under moving load assure the very last word in safety and performance.

Why not be on the safe side—specify Duff-Norton Jacks for your lifting requirements—readily available through Mill and Mine Supply Dealers and Jobbers—everywhere.

Duff-Norton Special 4-way Chain Jack No. 1523 combines head lifting, foot lifting, chain lifting and claw lifting. May be also operated at any angle for shoving, pushing.

Duff-Norton Automatic Lowering Jacks—the only jacks with the world renowned Genuine Barrett Mechanism. 5, 10, 15 and 20 ton capacities.



Duff-Norton Ball Bearing Bridge and Wrecking Jack with footlift. Especially suitable for rough, heavy duty usage. Footlift permits handling low loads.

THE DUFF-NORTON MANUFACTURING CO.
"The House That Jacks Built"
PITTSBURGH, PA.

connection for joining the chute to the roller conveyor.

At the top, the chute end is at right angles to the belt, and contact with the side of the belt conveyor frame is made through ball bearing rollers of different lengths, which provide a switch-like takeoff from the belt.

Packages are switched off the belt conveyor by a frame of welded round stock which is secured to a vertical shaft attached to the side of the spiral chute. While in the "taking off" position, it is held there by a thumbscrew. When not in use, it is swung clear of the belt. The entire takeoff is held in position by a pair of heavy turns consisting of 2 x ½-in. stock shaped similar to an icebox latch, with an eccentric bushing to obtain a tight grip. These turns engage the under side of the angle frame supporting the belt conveyor.

For those small orders that tie up your mass production set-up it may be worthwhile to make a special layout to handle small custom jobs.

A Quick Way to Prevent Short Count

H. B. LEACH, *Head of Standards Department, Pro-phy-lac-tic Brush Company, Florence, Mass.*

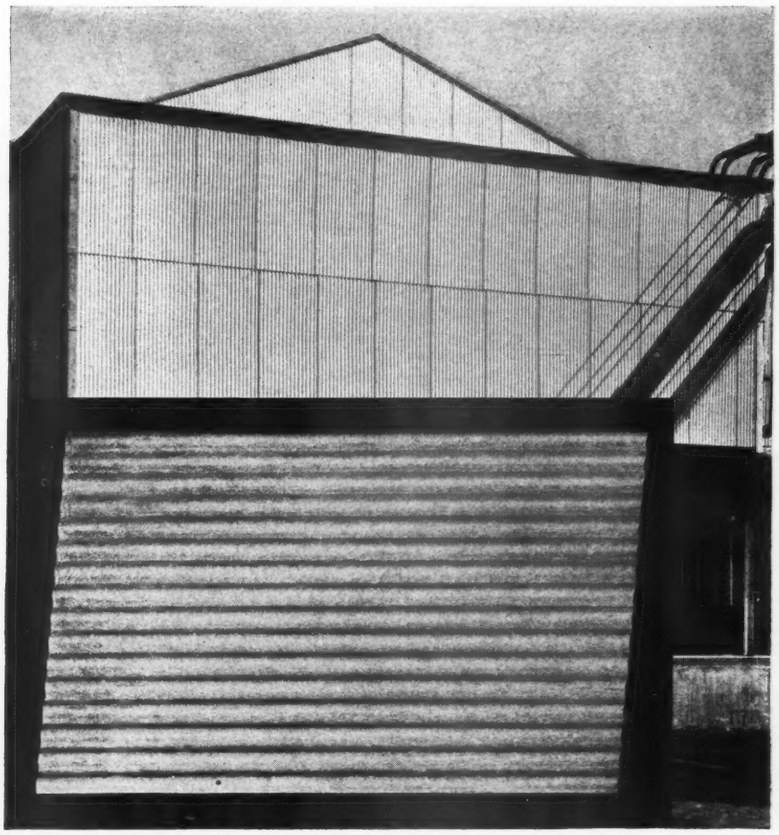
Toothbrushes for export are packed in non-window, single boxes, and every carton of toothbrushes is weighed. Not that we are at all interested in knowing what it weighs, but we *do* want to be sure that each one contains a dozen brushes.

Each toothbrush is individually boxed and wrapped in Cellophane. This is done on an automatic packaging machine, and although it does not often happen, this machine misses once in a while and carefully wraps a box that has no brush in it.

The girl who packs the toothbrushes, a dozen of the single boxes to the carton, can be absolutely sure that she puts in the right number of boxes. That is easy, because naturally the carton holds exactly twelve boxes. But how is she to know there actually is a brush in each single box? She could shake each one and listen for the telltale rattle.

Obviously that would be a poor way out. Besides, she customarily picks up two or three of the single boxes at a time. The better way is to weigh each carton right after

Fire-resisting . . . . . it lasts almost forever



K&M

CORRUGATED ASBESTOS

K&M Corrugated Asbestos—made of asbestos fibre and Portland cement under enormous pressure—is a strong, dense, tough sheet, fire-resisting and weather-resisting. Corrugations give it greatly increased strength, and help in obtaining correct alignment, resulting in water-tight joints.

It is used to great advantage for roofing, siding and partitions in skeleton-frame industrial building, for storehouses, lumber mills, wood working plants, cooling towers, power houses. Like all K & M products, it has exceptional durability and uniformity. Behind these products is more than 60 years of experience in the development of asbestos and magnesia materials of all kinds.

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"Featherweight" 85% Magnesia Pipe Insulation, Blocks and Lagging • Asbestos Pipe Insulation in sections • Asbestos Insulation in sheets and blocks • Asbestos Insulating Cements • Asbestos Packings: rope, cord, and sheet • Asbestos Gaskets, Gasket Tapes and Cloth • Friction Materials • Refractory Cements, dry and plastic • Asbestos-Cement Sheets in corrugated and flat form.

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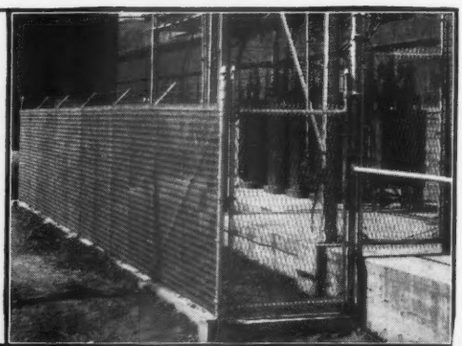
KEASBEY & MATTISON COMPANY AMBLER, PENNA.

Now CUSTOM MADE
TO YOUR SPECIFICATIONS

FACTORY ENCLOSURES

● The Steelcrete Handbook will show you many ways to use this diamond mesh of Expanded metal. For tool rooms, supply storage, locker systems and every kind or size of enclosure, Steelcrete offers you strong lightweight construction, simple and economical to install and requiring virtually no maintenance expense. Through the Steelcrete Factory, or a conveniently located Steelcrete Shop, you are supplied standard units of mesh with all necessary accessories—custom-made enclosures ready for assembly by your own men or by Steelcrete workmen. Window and machinery guards, tool baskets, trays, racks, shelving and countless other items are better made of Steelcrete Expanded metal—all free from burrs and sharp edges. Send for the Steelcrete Handbooks.

● Steelcrete Expanded Metal Fence is now available for all types of commercial enclosures. It is furnished in flat sheets of diamond mesh cut from solid COP-R-LOY, complete with gates, posts and all fittings. Ask for Special catalog.



THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
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Export Office: 330 West 42nd St., New York, N. Y.

she has put the dozen individual boxes into it.

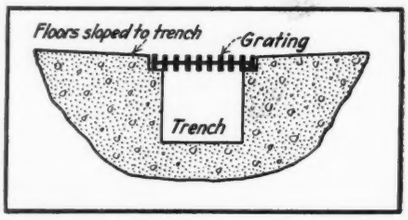
This is done with *no waste motion.* At her elbow is a pair of scales. On one of the pans is a dummy carton of brushes—a sort of "stooge". There is just one thing wrong with this carton. It contains only *eleven* brushes. The rest is simple. The operator places each carton she packs on the other pan. If it tips the scale, it is clearly heavier than the "short" carton, hence she can be sure it contains the allotted dozen. If it fails to tip the scale, on the other hand, she can be equally sure that it is shy a brush, and of course, it is but a moment's work to check the dozen single boxes and catch the empty one.

●

Trenches Carry Off Non-Septic Liquid Wastes

S. H. COLEMAN, *Roanoke, Va.*

Disposal of non-septic liquid wastes in the process industries can often be facilitated by using open trenches in the floors of operating departments, rather than the usual underground drainage piping. These trenches are especially useful where the liquids handled contain solids which would clog the underground traps of ordinary floor drains. Other advantages are: visibility of effluent, ease of cleaning, centralized catch-basin, no restriction of inlets. This last is especially valuable in the



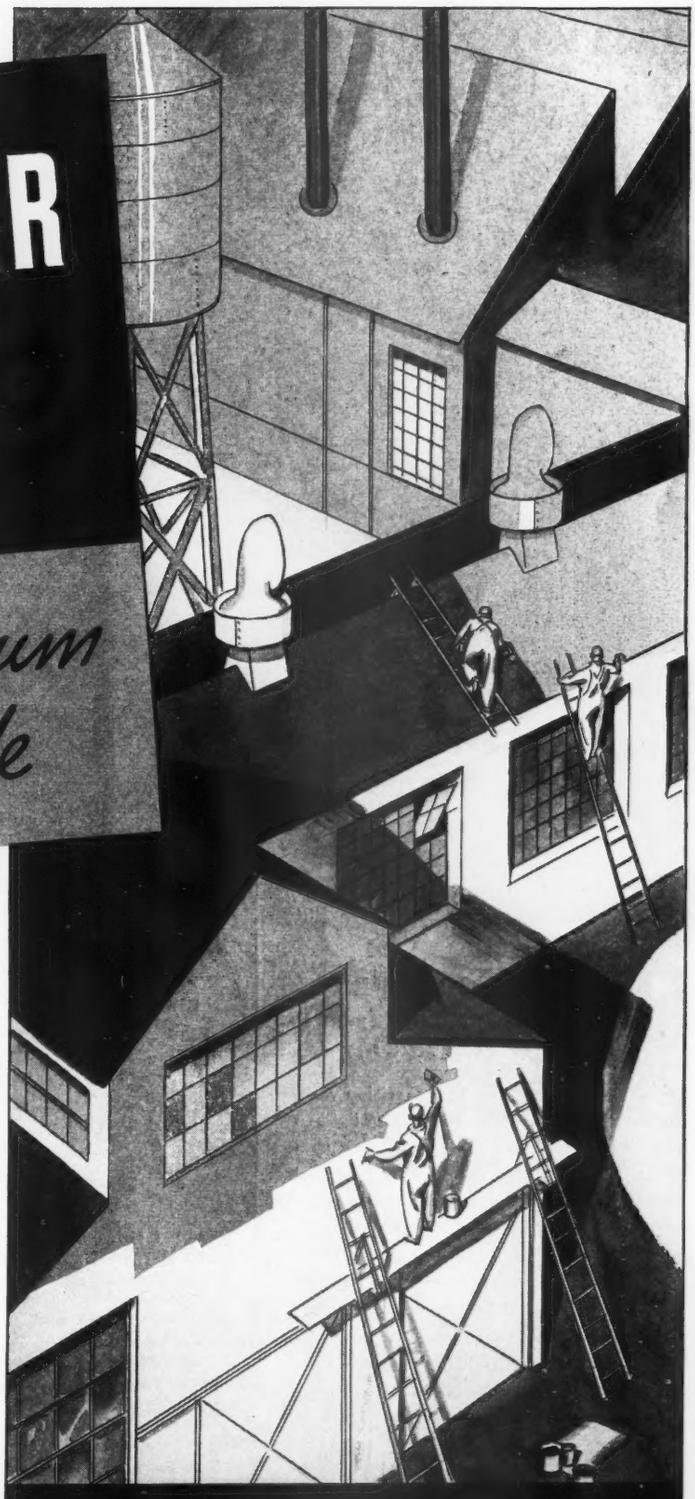
event of serious spills of material, flooding, and when washing down floors.

In one department of a large hemical plant it was found necessary to replace all concealed drainage piping with open trenches to reduce the expense of removing solids which formerly plugged the whole system on occasions. The substance processed was of such a nature that it coagulated in the presence of water, and when tanks containing this material slopped over it meant at least 12 hours of lost production time in addition to the cost of cleaning the drains.

Floor trenches covered with removable sections of steel grating proved to be the answer to this problem. Built of concrete, these

IT'S COOLER INSIDE

with Aluminum paint outside



Sun's heat on the roof seeps through on your workers. Bright summer days become hotter inside, sapping efficiency.

You can ward off part of that radiant heat by painting the roof with Aluminum Paint, just as refineries and oil companies do with their tanks. On buildings with uninsulated metal or composition roofs, the reduction in temperature inside is appreciable.

Aluminum Paint is protective as well as reflective. Guards against weathering and corrosion longer than ordinary paint. Thus, roof maintenance is lowered and buildings keep their trim appearance.

All these advantages apply not only to roofs but also to all other exterior surfaces, wood, steel, brick or concrete. That's why you see more and more industrial buildings painted with it every day.

★ ★ ★ ALCOA ALUMINUM ALBRON ★ ★ ★

The best Aluminum Paint consists of genuine Alcoa Albron Paste or Powder and a good vehicle suitable for the surface to be painted. Buy such paint from reputable paint manufacturers, their jobbers and dealers. For Aluminum Paint literature, write ALUMINUM COMPANY OF AMERICA, 2126 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALBRON

paste and powder for

ALUMINUM PAINT

Have you enough light
for precision work like this?

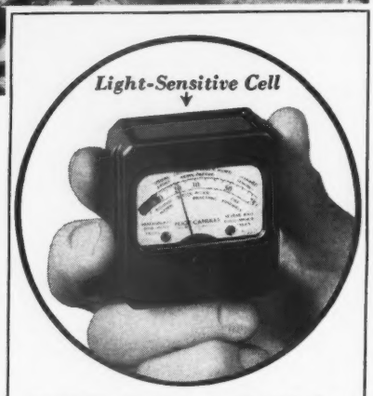
This drilling operation requires care and exactness which better lighting of more than 100 footcandles helps insure.

LIGHT METER
has answer

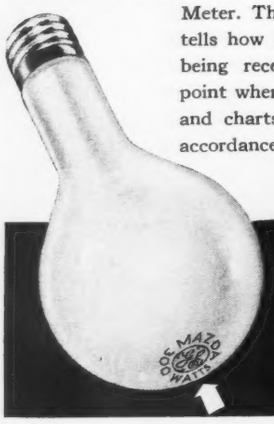
Certain kinds of close seeing, precision work require from 50 to 100 footcandles of light to be done efficiently and with minimum eyestrain. Yet in many plants today skilled workers are struggling along with 10 or 15 footcandles simply because no one ever measured the lighting or attempted to find out how much light various seeing tasks need.

To save men and money, many plant managers and superintendents are making regular check-ups with a General Electric Light Meter. This instrument tells how much light is being received at any point where it is placed, and charts prepared in accordance with modern seeing requirements tell how much light is needed for different shop and office tasks.

For specific information write to General Electric Company, Dept. 166, Nela Park, Cleveland, Ohio.



MEASURE LIGHTING WITH NEW G-E LIGHT METER The G-E Light Meter indicates light as simply as a thermometer measures temperature. Every plant executive should have one. Costs $11.50.



GENERAL ELECTRIC
MAZDA LAMPS
They stay brighter longer

trenches were lined with asphalt or tile set with acidproof cement. After their installation, when a slop-over did occur, the coagulated material was easily removed and production could be resumed after a very short interval.

Temporary overloads that are constantly blowing fuses can probably be better handled by using easily reset circuit breakers.

When Welding or Cutting Take These Precautions Against Fire

Suggestions for fire prevention through the safer use of porta cutting and welding equipment have been issued by the inspection department of the Associated Factory Mutual Fire Insurance Companies, Boston.

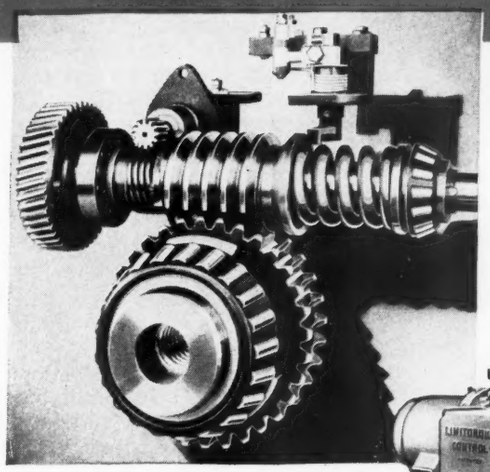
Analyses made in a group of plants showed that fires incident to the use of cutting and welding equipment have so far this year increased at a rate 45 per cent above 1936, and 64 per cent above 1935. During the past nine years 591 such fires have caused a total loss of $652,000.

The chief danger appears to lie in the use of such equipment in unsafe locations, or without proper precautions. Many operators fail to realize that sparks or globules of hot metal can, and often do, ignite combustible material at a distance of 35 ft. or more. The suggested remedy is to forbid the use of cutting and welding equipment unless the location has been inspected and approved by a responsible authority. These recommendations are made:

1. Appoint a competent supervisor with authority to establish and enforce suitable precautions, allowing work only under a signed permit, in designated areas and by experienced operators. Insist on the observance of necessary precautions by outside contractors.
2. Always keep automatic sprinklers in service during cutting and welding.
3. Use no cutting and welding equipment in unsprinklered, combustible buildings, or where floors and partitions are not tight. Sweep floors and wet down wooden floors, or cover them with sheet metal or its equivalent. Prevent sparks from outdoor work entering building openings.
4. Before starting work remove any combustible material at least

BROKEN or DAMAGED Valve Stems and Seats are impossible with—

LIMITORQUE Automatic CONTROL



By the mere push of a button, LIMITORQUE automatically opens or closes large or small valves, at just the proper speed. It may be fitted to any size valve, in most any position, and in any location; and being hermetically sealed, it is unaffected by dust, dirt, heat, fumes or moisture. LIMITORQUE is for use with gas, water, oil, air and liquids of all sorts.

Hundreds of installations in numerous industries and on shipboard are living testimony to the great success of Valve Operation by LIMITORQUE.

Send for complete catalogue or tell us your problem and one of our Engineers will be glad to submit a proposition to you—without obligation.

Above: Philadelphia Limitorque Automatic Valve Control attached to a large gate valve. Note the clear-cut, compact construction and provisions for manual wheel operation.

With LIMITORQUE, there is no danger should the valve disc or gate meet with any undue obstruction during the closing stroke . . . And, during normal operation, the valve cannot jam. On the other hand, the above device allows the motor to exert its full torque when closing against pressure and velocity.

Remember, the exclusive (patented) Limitorque Torque Spring and the Limit Switch, do the trick (illustrated below). It permits predetermined Torque Setting, which actually adjusts the tightness of the valve on its seat. The patented torque spring absorbs any undue strain in the seating position as a result of the kinetic energy of the rotating parts.

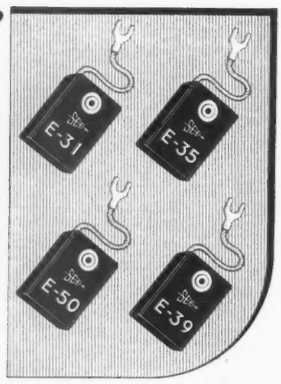
PHILADELPHIA Limitorque

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers

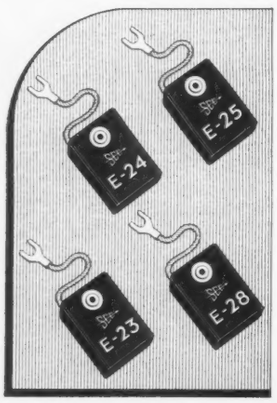
ERIE AVENUE & "G" STREET, PHILADELPHIA, PA.

SERIES *E for Excellence*



For a new idea of modern motor and generator brush performance possibilities, try a set of Speer Series E brushes — electro-graphitic brushes with an extremely wide range of applications — from the main roll drive motors in rolling mills and the largest generators or rotary converters to the smallest fractional horsepower motor in your plant.

The right grade on any machine you choose for a test will show you, better than words, what "Excellence" in brush performance really can mean. Speer engineers will gladly recommend the grade that is best for you. As a first step, write for the Speer brush data form.



Speer Carbon Company
ST. MARYS, PA.

SCC

7413

AIR CONDITIONING EFFICIENCY *BEGINS HERE*

Air-conditioning equipment in Baltimore Trust Building, Baltimore, Md. Ducts and pipe lines covered with Carey Insulations.

Carey INSULATIONS

Higher efficiency . . . lower operating costs are daily becoming more important in air conditioning installations. In meeting these requirements, Carey Insulations offer a basic starting point.

For over 60 years, we have been anticipating industry's new demands by developing high efficiency insulations to meet every service condition from sub-zero to 2500°F. Write for copy of Carey Insulation Handbook.

ASPHALT — ASBESTOS — MAGNESIA

Roofing . . . Flooring . . . Insulations . . . Roof Coatings and Cements
Waterproofing Materials . . . Expansion Joint . . . Asbestos Paper and Millboard

THE PHILIP CAREY COMPANY · Lockland, Cincinnati, Ohio
Dependable Products Since 1873 **BRANCHES IN PRINCIPAL CITIES**

35 ft. away, or protect by asbestos or sheet-metal curtains or guards. Shut down processes exposing combustible fibers or materials. Remove deposits which might be exposed to sparks.

5. Do not permit cutting or welding near flammable liquids or combustible vapors or gases. Thoroughly ventilate locations where such liquids or vapors have been present.

6. Do not work on closed containers which may have held flammable liquids of combustible materials. A film of such material on metal surfaces may produce explosive vapors when heated. Purging with air or steam, or flooding with water, is sometimes effective.

7. Do not perform cutting or welding operations on ducts unless sure that these are clean and free from combustible deposits.

8. Have extra men with fire extinguishing equipment watch for sparks and drops of hot metal, observing cracks, openings, curtains, guards, and floor condition for at least 30 min. after operations have been finished.

9. Keep all equipment in good condition, and use according to the maker's instructions.

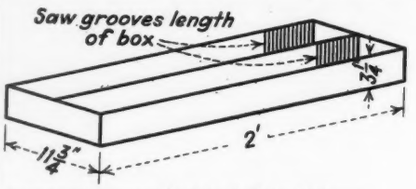
Handle acetylene cylinders carefully. Rough handling, knocks, or falls are likely to damage cylinders, valves, or fuse plugs, and cause leakage.

Operating Ticket File Has Adjustable Spacers

KARL BAUER
International Steel Company
Evansville, Ind.

Our problem was to find some sort of file in which to put our operating tickets. It was necessary that this file be adjustable to fit the number of tickets for each order, as some of the orders required more tickets than others.

The tickets measured 5 x 3 in. and were of thin paper, making it impossible for them to stand without some

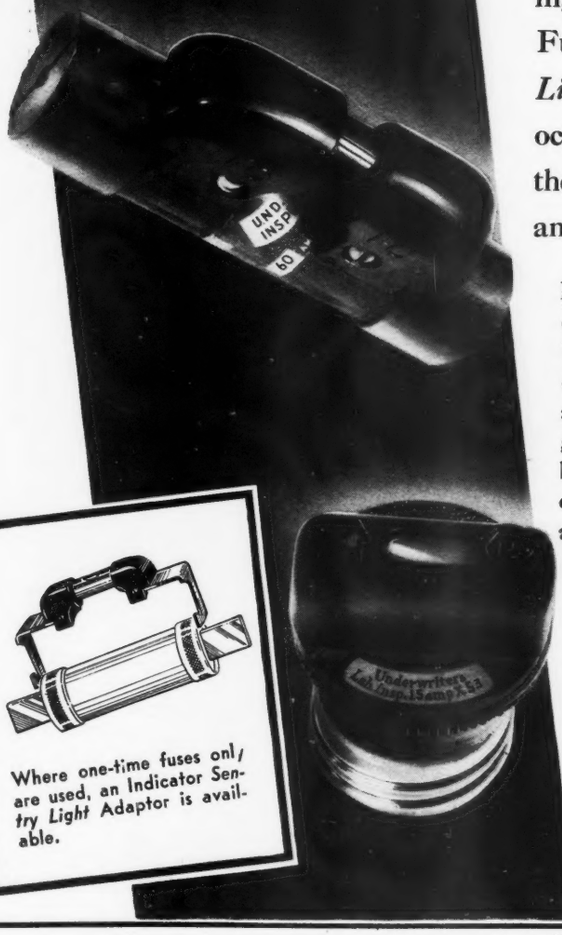


support immediately behind them.

A box was designed 2 ft. long, 11¾ in. wide, and 3¼ in. deep, made

FUSE 'GUESSWORK' ENDED!

Indicator Perfects the Fuse with the "SENTRY LIGHT"



NO need to waste costly production time locating blown fuses. When Indicator Renewable Fuses guard circuits, a tell-tale neon *Sentry Light* glows instantly when an overload or short occurs. The shock-proof safety handle in which the *Sentry Light* is enclosed eliminates hazards and serves as a perfect fuse puller.

Indicator Renewable Cartridge Fuses are built not only to *detect* trouble, but to *prevent* it. Approved by Underwriters Laboratories, Inc., Indicator Fuses are carefully constructed to rigid specifications that assure utmost safety and dependability. Extra heavy gauge fibre and brass withstand a greater number of blows and outlast average fuses. Minimum number of loose parts. Indicator Renewable Links are standard and interchangeable.

Where one-time fuses only are used, an Indicator Sentry Light Adaptor is available.

In all installations requiring plug fuses—the Indicator 6 Multiple Fuse is unequalled for convenience, safety, and time-saving. Six fuse links housed within one chamber permit the fuse to be used six separate times without removal from the fuse socket. Should the fuse blow, the *Sentry Light* glows and is easily detected even in the dark. By turning the safety handle one notch to the right, a new fuse link is brought in circuit.

Write Department 201 for folder containing full details about complete line of Indicator Fuses.

INDICATOR CORPORATION

THE FUSE WITH THE "SENTRY LIGHT"

32-36 GREEN ST. NEWARK, N.J.

GOULDS PUMPS CUT COSTS

Because Goulds Pumps operate at a low maintenance cost and give longer life, practically every industry uses Goulds Pumps to obtain dependable service and lower pumping costs. These highly efficient pumping units are saving many productive pumping hours—many dollars, by providing twenty-four hour pumping service — free from shut-downs for repairs.

Goulds Centrifugal Pumps, Piston Pumps, Rotary Pumps and special pumps are available to meet individual requirements. Sizes suitable for pumping water and other industrial liquids at any rates and pressures.

Obtain all the details about how Goulds Pumps cut pumping costs. Write directly to us.

GOULDS LEADERS SINCE 1848 *manufacture pumps for every purpose*

GOULDS PUMPS Inc.
SENECA FALLS, N. Y.
ATLANTA, BOSTON, CHICAGO, HOUSTON, NEW YORK, PHILADELPHIA, PITTSBURGH, TULSA, Representatives in all Principal Cities

7010-A

of ⅜-in. material, with two equal compartments 5⅛ in. wide running the length of the box. On the inner sides of the compartments we cut grooves ⅛ in. deep and ¼ in. apart. Pieces 5¼ x 3 in. were then cut from 16-gage galvanized sheets to slide into the grooves, making adjustable compartments for each order's tickets.

For example, if an order required 1 in. of space, three of the ¼-in. grooves could be skipped and a piece of galvanized sheet slipped into the fourth groove, thereby holding the tickets tightly together.

This system prevents the thin paper from curling up, and always keeps the tickets in a compact and accessible position.

Lamp sockets are not intended as a source of power for portable electric tools, and to use them as such is to run the danger of overloading, short-circuiting, and breaking them.

Simple Precautions Will Prevent Ladder Accidents

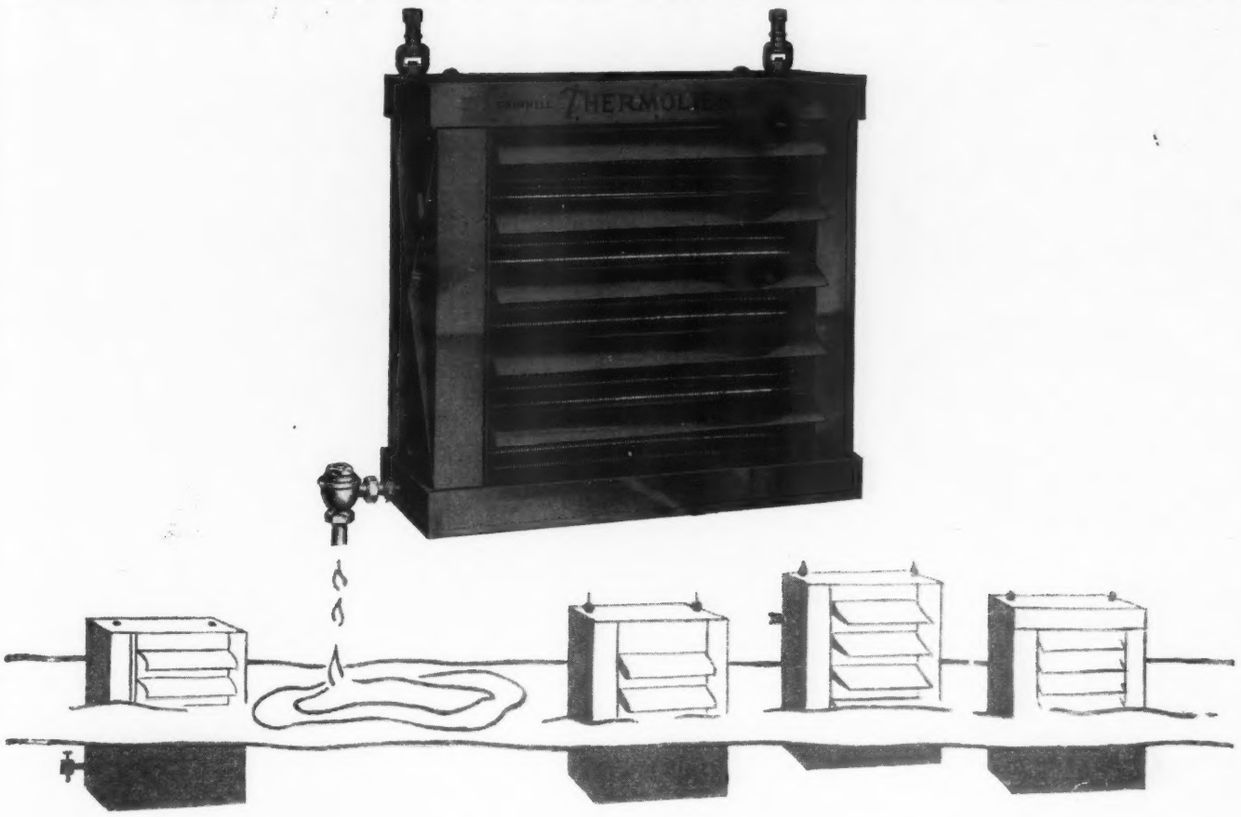
HARRY W. BENTON, *Plant Engineer Pratt & Whitney Division, Niles-Bement-Pond Company, Hartford, Conn.*

It is natural for any ladder to slip if it is not provided with some sort of safety shoe.

In our plant it is standard practice to use safety shoes with cork inserts for all ladders placed on concrete or brick floors. All ladders used on wood floors are equipped with removable metal spikes which can be taken off from time to time, resharpened, and put back in place. We have forbidden the use of ladders with metal spikes in any part of the plant where there are concrete or brick floors.

Also as standard practice, all employees are instructed that any defective ladder, regardless of where it may be, or in what department, must be sent to the carpenter shop. The head of the carpenter division has instructions to inspect the ladder and if in his opinion it can be repaired so as to be entirely safe for further use, he is to proceed with such work; otherwise, he is to saw it up for scrap. A stock of new ladders is always available and a new one is supplied to replace the one which has been scrapped.

We are constantly insisting on compliance with these rules, in the interest of safety for employees. It is only by such practice that we can avoid ladder accidents.



GO *ABOVE* THE "LAZY WATER" LINE FOR YOUR LOW COST HEAT!

EVERY TUBE AN EXPANSION BEND . .

The strain of expansion and contraction is removed from Thermolier — every U-tube is an expansion bend, solidly joined to the header.

The "lazy water" line marks the top of the collected condensation in a unit heater. Thermolier, kept *above the line* by continuous removal of "lazy water," operates at top efficiency with *all* of its heating surface, *all* of the time.

That's one of the big reasons why Thermolier returns substantial savings over other type heating systems. The Internal Cooling Leg that makes this continuous drainage possible is an exclusive feature of Thermolier — one of its 14 points of superiority.

A Grinnell Thermolier will provide a "roomful" of heat wherever you put it . . . eliminate cold corners and hot ceilings. Plan to install Thermoliers now for a productive economical winter! The Thermolier Data Book, free on request, will give you details of advantages and savings. Grinnell Co., Inc., Executive offices, Providence, R. I., Branch offices in principal cities.

GRINNELL THERMOLIER

THE UNIT HEATER WITH 14 POINTS OF SUPERIORITY

A DAMAGED PACKAGE MAKES A MIGHTY POOR SALES REPRESENTATIVE

Boxes, cartons (corrugated and fibre), bundles, skids, bales, and packages of all kinds are reinforced to stand heavier shocks with lighter materials under Signode packing methods. The shipper and the consignee both gain through lower costs, but the shipper earns added good will.

● What shall it profit a manufacturer to spend time and money developing a sales-stimulating package . . . if it arrives at its destination looking as sloppy as a water-front hobo?

Says A. L. Green, Freight Claim Div. Assn. of American Railroads: "The shipper who does not know what proportion of his shipments is reaching customers in non-salable, non-usable condition is neglecting an important source of dissatisfaction and possible loss of business."

Learn how and why packages protected with Signode Steel Strapping reach their destination as neat as West Point cadets on parade. Signode Steel Strapping protection does more than safeguard packages and merchandise. It cuts packing and shipping costs as well. Write for facts on Signode advantages.

SIGNODE STEEL STRAPPING CO.
2621 N. Western Ave., Chicago, Ill.
361 Furman Street, Brooklyn, N. Y. — 452 Bryant Street, San Francisco, Calif.
Grant Building, Pittsburgh, Pa.

SIGNODE
Tensional Steel Strapping

Questions and Answers

How Often Overhaul Motors?

We operate several hundred three-phase, 440-volt motors, mostly 5 to 20 hp., with a few 100 hp. or larger. In the majority of cases failure of a motor causes a serious interruption. For that reason we used to take down and overhaul all important motors once a year, besides giving them a careful inspection about every two weeks. Overhauling included cleaning, testing, and painting the windings, checking bearing wear, and in general going over every part. Our conditions are about average to rather severe (there is a good deal of steam and moisture in some departments, dust in others), but failures were very infrequent and usually were the result of some accident.

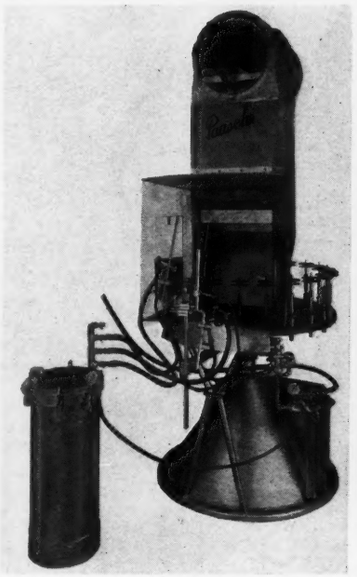
Several years ago we discontinued the yearly overhauling. Now we inspect motors every three or four weeks, and I know that this inspection is not very thorough. So far there has been only a slight apparent increase in failures, but I wonder whether we are piling up trouble for the future. So my question is: Did we spend too much money before on motor maintenance, or aren't we spending enough now? In other words, is a yearly overhaul justified, or is it a waste of money? I should like to know how other readers feel about this. —*V.C.*

MANY FACTORS determine the length of time a motor may be operated dependably, without a general overhaul.

My experience has been that motors operating in clean, dry locations will, if properly loaded and connected to the machines, give dependable service for four or five years without a general overhaul. Of course, they must be cleaned and oiled at regular intervals. The inspector or oiler should change the oil when needed, blow out the dust with clean, dry air, and see that the drive is not causing undue bearing strain or vibration.

It has been my policy to have all motors inspected at least once a month, and notes made of any abnormal conditions. Inspection consists of checking the oil and adding more or changing it when needed, blowing out dust, checking the air gap for bearing wear, noting visually the condition of the insulation on the coils, examining the rotor of a.c. motors for corrosion, noting the condition of commutator and brush rigging on d.c. motors, and checking the drive for excessive belt tension or coupling misalignment. An experienced man can inspect a considerable number of motors in an eight-hour day and give

10560 KODAK REELS
Coated per 8 hr. day
WITH
Paasche AUTOMATIC UNIT



SPEEDS PRODUCTION . . . SAVES MATERIAL

● Hundreds of manufacturers are today using Paasche Automatic Aircoating Machines — some as many as five and six units in a single plant — to speed production, cut material costs, and improve their finishes.

A prominent manufacturer tells us that a unit similar to the one illustrated above is saving him $96.00 each day in material, and is displacing seven regulation spray booths. Moreover, greater uniformity of application is constantly assured.

This is not an isolated instance. Others are doing equally as well where their product lends itself to finishing by the Automatic Process. Labor savings as high as 250% have been recorded, with rejects held to an absolute minimum. Comparable savings may be effected in your plant.

Kodak reels, golf balls, small electric motors, metal radio tubes, metalpencils, lipstick holders, clock cases and dials, flat metal and wood sheets, wall board, dinnerware and hundreds of similar objects are being coated on Paasche Automatic Units today.

Let us analyze your problem. It involves no obligation to write or have an experienced Paasche representative call on you.

Paasche Airbrush Co.
1901 Diversey Parkway Chicago, Ill.

STEP OUT - *Cut Waste Again!*

An Elwell-Parker System handling, tiering, reclaiming loads in a large storage and warehousing project. Note different types of Trucks performing a variety of load-handling operations. The System includes correct types and sizes of Truck equipment, each provided with suitable attachments for doing your work at lowest cost.*

THIS is no day for industry to pass over its materials-handling processes with a complacent glance. In an alarming proportion of manufacturing plants today, prevailing methods are so inadequate, obsolete and wasteful that profits already have been reduced to a dangerously narrow margin.

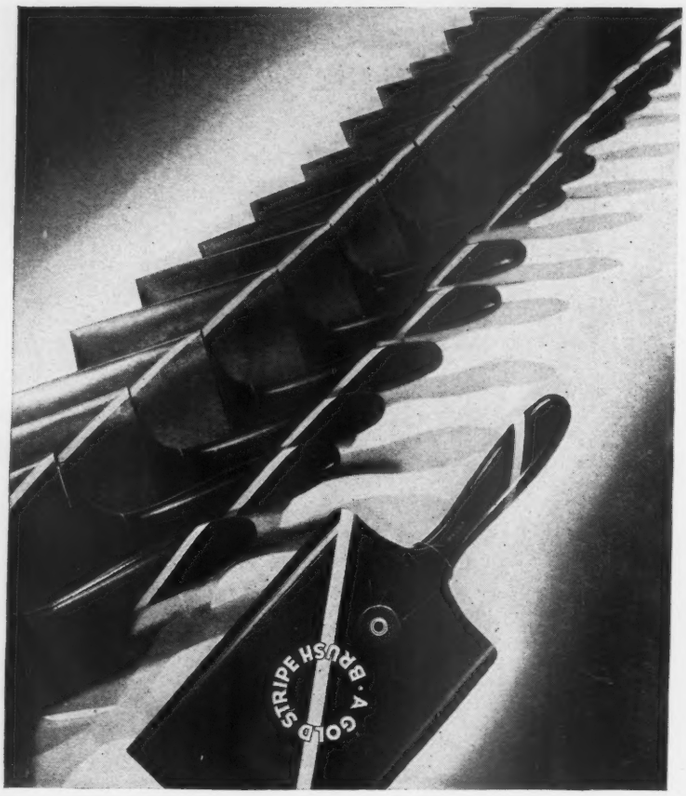
To step out—to cut waste *again*—means keeping alert to the cost of each process in your materials handling. It means creating the utmost savings that Elwell-Parker Truck equipment can establish and *maintain* for you: and of course it means calling in an experienced Elwell-Parker Representative to consult with one of your own men.

An Elwell-Parker System* (see illustration above) will tie all your load-moving operations into a single efficient, low-cost flow. The Elwell-Parker Electric Co., 4323 St. Clair Ave., Cleveland, Ohio.

New Type **ELWELL·PARKER** *Trucks*

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906

NEW BRUSH SERVICE



ORDERS for industrial brushes can now be filled on a 24-hour, "back-the-same-day" basis through the 74 centrally located warehouses of the Pittsburgh Plate Glass Company.

Why not concentrate your brush requirements in this one reliable source of supply?

There is a "Pittsburgh" warehouse near you—carrying a complete stock of Gold Stripe Brushes for all types of paint jobs and a full line of Industrial Brushes, such as Floor Sweeps, Mill Dusters, Wire Scratch and Casting Brushes.

Refillable Spiral Wound Brushes of wire, horsehair and tampico can be furnished on special order for large scale production.

Write today for free illustrated catalog. State whether interested in brushes for maintenance or production, and what the production problem is. We will gladly place our engineering staff and service facilities at your disposal.

PITTSBURGH
PLATE GLASS COMPANY
BRUSH DIVISION · BALTIMORE, MD.

BRISTLE, WIRE AND TAMPICO BRUSHES FOR EVERY INDUSTRIAL NEED

a reliable report on any irregular conditions. However, it is a job for a real electrician, not a helper or oiler.

With three-phase induction motors it is good practice to remove a motor from service when the bearings need replacement, and at that time clean it thoroughly, dry out, dip and bake the windings, and paint the frame inside and out. This treatment will put the motor in first-class condition and add materially to the life of the windings.

CHAS. W. WARD, *Kansas City, Kan.*

I WOULD say that V. C. may have spent too much money in maintaining the electrical equipment in his plant, but unless unnecessary work were done the resulting freedom from interruptions and repair bills likely offset the expense.

Electric motors do not wear out so quickly as the average machine, and they are worthy of good care. A maintenance chief should insist upon inspection at least monthly, more frequently when lubrication trouble is encountered, or leakage suspected. Regularity of inspection insures the checking of every motor. Usually motors in the dirtiest locations need the most attention, and get the least. When regular cleaning is neglected, the repair man is the one who profits.

Whether annual overhauling is required, depends on the conditions. The problem is principally one of housekeeping. When windings are kept clean and properly painted the deterioration to which insulation is subject is forestalled, bearing housings are free from grit, and incipient failures are detected in plenty of time.

It is my suggestion that a program be laid out in advance. It is not advisable to try to do all the job at once, unless a seasonal shutdown makes this possible. Good records are essential. They should include the date of inspection, and the work done, along with the name of the inspector or repairman.

Failures do not pile up all at once when maintenance is discontinued, but a gradual increase in the number of interruptions will usually be noticed. Dirt, grit, moisture, and grease are arch enemies of motors, attacking both windings and bearings. Proper care is the only protection against them.

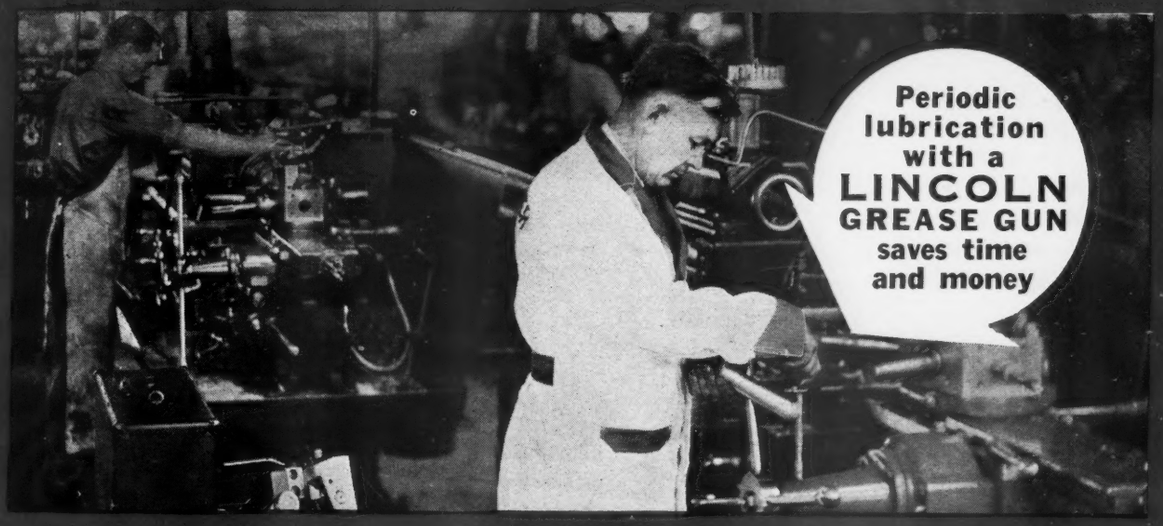
EDWARD F. WEHLAGE, *Dubuque, Ia.*

FEW MOTORS need to be taken apart every year. In fact, no definite period can be set up for the safe operation of a motor. I have known motors to run 20 to 24 hr. a day for eight years, and at the end of that time they were apparently as good as new.

Generally speaking, bearings are the most important item in a.c. motors. Bearings must be properly fitted and oiled, and free from excessive end thrust, vibration, and side pull. The degree to which these conditions are maintained will determine the amount of trouble that may be expected.

Periodic air gap checks and insula-

Proper Lubrication is Practical Insurance against bearing failures and expensive shut-downs



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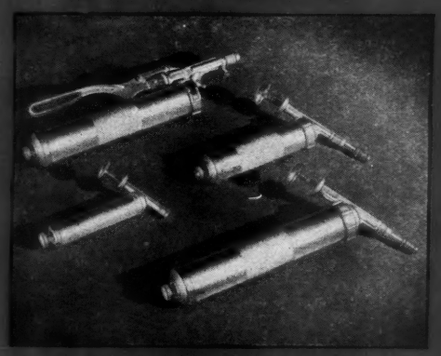
You can avoid grief and save money by having the machines in your factory properly lubricated at regular intervals.

Lincoln makes a wide range of equipment for the most efficient application of lubricants, and our distributor can supply the equipment that is best suited for the various maintenance applications in your plant.

If you make a product or products requiring lubrication during assembly or upon completion and prior to shipment—Lincoln also manufactures hand and power operated guns and equipment designed for such production operations.

Get details on this equipment by asking for a copy of Catalog No. 60. It shows the complete line of Lincoln Power Operated Lubricant Dispensers, Hand Guns, Fittings and Accessories.



A few of the many types of hand operated Lincoln Grease Guns are shown above. The complete line is shown in Catalog No. 60.

Model 246 ELECTRIC LUBRIGUN (shown above) is a compact, portable unit. Complete with 7 ft. hose and control valve with nozzles for KLEENSEAL, hydraulic, zerk and pin-type fittings.

Lincoln KLEENSEAL and Button Head Fittings in all types and sizes are available for replacement and modernization needs.

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Clark Telescopic Finger Tilt Truck — the machine of a thousand uses — places steel castings on bed of planer.

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Telescopic, Finger Tilting

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—a lifting, tilting, speeding, tiering marvel. An intra-plant freight hound keeping raw materials and finished goods moving—tiers them high for economical storage.

Powered by a 6-cyl. industrial truck engine, it's capable of continuous 24-hr. service.

Its steel fingers, 42″ long by 6″ wide, with spread adjustable to 40″, slip under any skid or pallet with 2″ underclearance. It handles 3 tons 25″ in front of vertical plate, lifts it quickly, tilts it back 18 deg., carries it at from 1 to 6 m.p.h., turns around in intersecting 86″ aisles, elevates it to 97¾″, tilts it forward 6 deg., tiers it neatly.

Clark material handling machines—lifting, tiering, towing, conveying—are made in over 50 models. Tell us your material handling problem—let us send you bulletins describing Clark machines that fit your particular requirements.

CLARK TRUCTRACTOR

Division of Clark Equipment Company

BATTLE CREEK, MICH.

tion tests made by a competent electrician, and the cooperation of those in charge of the driven unit, will give ample warning of failure.

Too much emphasis cannot be laid on the necessity of putting a competent maintenance man in charge of motor upkeep. If he knows his job you will not spend too much on maintenance, nor will you have too many failures. G. LINDGREN, *Troy, N. Y.*

Readers Want Answers

How Distinguish Between Phase Wires?

We experience difficulty in getting the proper direction of rotation of the three-phase motors driving portable hoists, conveyors, and certain other equipment that is plugged into any one of a number of stations. That is, at one or more stations the rotation may be correct, but at others it is reversed and motor leads must be interchanged. I presume the cause of the trouble is that the same line wires (1, 2, or 3) are not connected to corresponding terminals of all receptacles. But, how can I distinguish the 1, 2, or 3 lines from each other, at the receptacles? I wish that other readers who have had this problem would tell me how they solved it. —L.S.

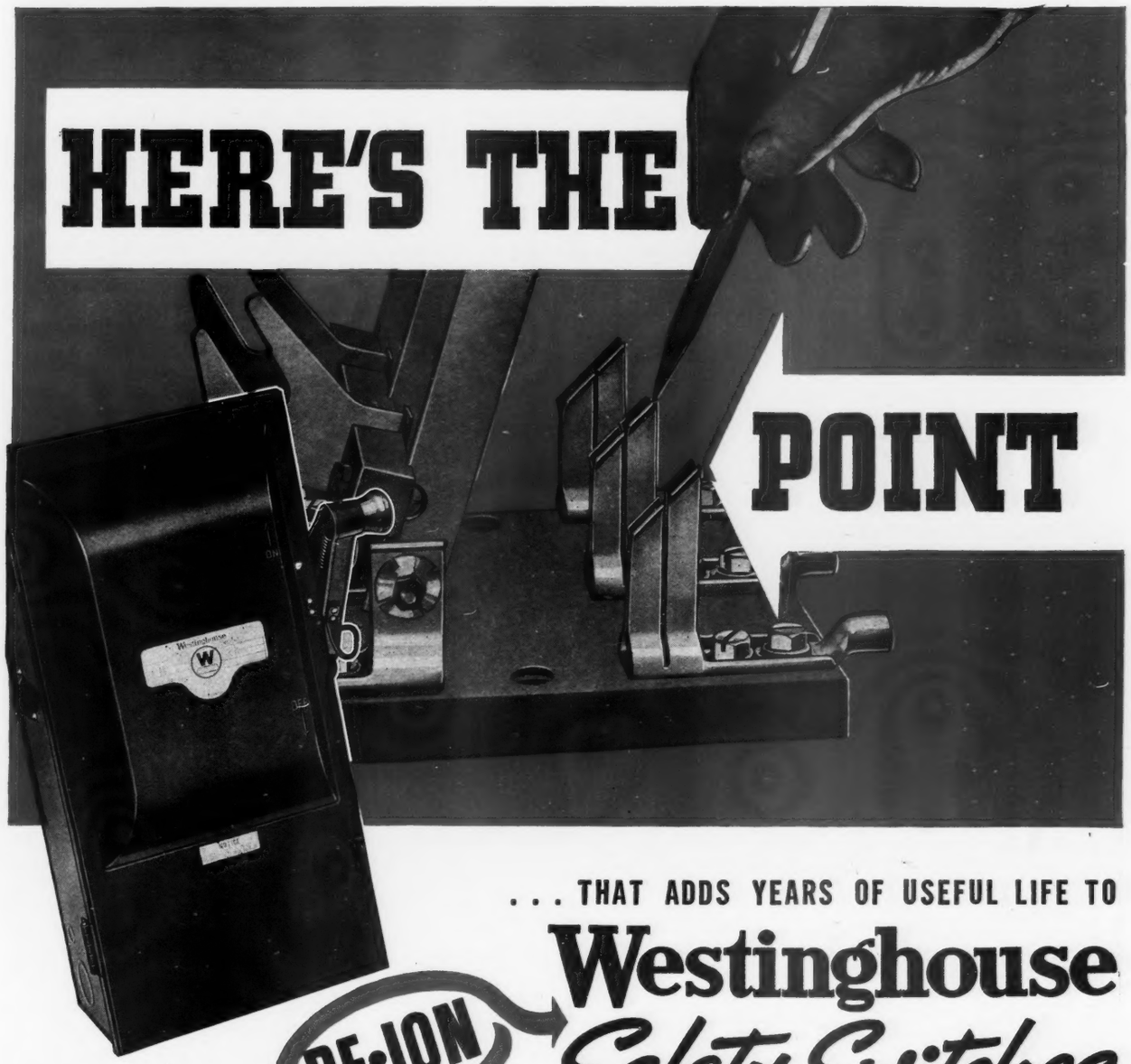
Setting Anchor Bolts in Old Foundation

A 150-ton ice machine is to be installed on the same concrete foundation used for the smaller machine which it replaces. We plan to enlarge the foundation by pouring more concrete around it, but it will be necessary to set some more anchor bolts in the old portion. How to place and anchor them for maximum strength is a problem that we have not yet solved. The old bolts are 1¼ in. in diameter and extend from 3½ to 4 ft. into the foundation. We should like to have the recommendations of other readers on the best way to handle this job.—E.C.

Flux for Soldering on Zinc Plate

In the assembly of certain electrical equipment we have had trouble in soldering one part to another which has a zinc-plated surface. A flux is required that will be non-corrosive without washing or neutralizing after soldering, and that will permit a joint to be made in less than 5 sec. If possible we should like to have a flux that can be incorporated in core solder. What flux do you recommend?–T.S.

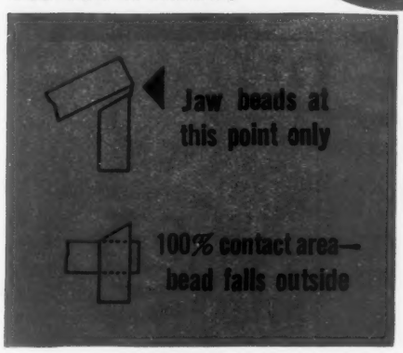
HERE'S THE POINT



. . . THAT ADDS YEARS OF USEFUL LIFE TO

Westinghouse DE-ION Safety Switches

See how it works!



The diamond-pointed break jaw of a Westinghouse Safety Switch is set to meet the extended blade. The arc which forms upon opening the switch is centered at these points, and the bead is confined to their immediate area. This area falls entirely outside of the contact surfaces when the switch is closed, insuring complete union between blade and jaw, unaffected by time and usage.

●The exclusive Westinghouse Diamond-Pointed Break Jaw and Extended Blade insure 100% contact. While this design does not pretend to do away with beading, it confines the bead to parts of the blade and jaw which are *not in contact* when the switch is closed.

In 575 and 600-volt switches, further protection is supplied by the famous Westinghouse "De-ion" arc quencher, which confines, divides and extinguishes the arc instantaneously. It prevents flashover and damage to contact parts.

A quick comparison will show clearly why Westinghouse switches will give you more years of efficient, trouble-free service. Maintenance is cut to a minimum by the use of one-piece or milled-and-ground copper parts and one-piece non-carbonizing composition bases.

A Switch for Every Purpose—All sizes and ratings, Types A, C and D. Call your local:

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Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

J 20299

A SWITCH FOR EVERY PURPOSE . . . AND ★ MOTORS ★ "DE-ION" LINESTARTERS ★ NOFUZE CIRCUIT BREAKERS

Sayings and Doings

•

Strikes and Insurance

Read your insurance policy. It comes as a distinct shock to many plant operating men that a number of widely used forms of insurance are suspended and of no effect variously under conditions of riot, strike, riot attending a strike, labor disturbance, or commotion.

The fact that the insured may have no connection with the disturbance, that it may be someone else's strike, or a "public" commotion, makes no difference.

That is the warning contained in a recent report of an insurance committee sponsored by the National Electrical Manufacturers Association. The committee's recommendations follow:

1. Insurance policies (principally all those covering property risks) should be examined carefully to determine whether or not coverage is effective under conditions of:

a. Riot, riot attending a strike, civil commotion, insurrection.
b. Strike not involving rioting, etc.
c. Malicious damage, sabotage, vandalism.

2. Wherever present fire policy does not cover one or more of the following, prompt consideration should be given to the desirability of covering such risks, namely:

a. Fire caused by riot, commotion, etc.
b. Fire following an explosion caused by riot, etc.
c. Explosion caused by riot, etc.

3. Where other forms of insurance fail to provide coverage indicated in "1," these cases should be reviewed to determine whether or not there exist any risks deemed serious in the particular case, and for which insurance should be provided.

4. Any additional coverage purchased, whether in the form of riot or vandalism or other endorsement of existing policies, or the taking out of new insurance, should be on the basis of indicated need. The stampeded or panic-stricken attitude has no proper place in insurance buying. With even less to recommend it, is any head-in-the-sand attitude which fails to determine as well as possible what the risks are, what may be safely assumed, and what should be covered by insurance.

5. Information included herein on various specialized forms or endorsements is not to be taken as a recommendation for their general adoption. They are, for the most part, designed for particular circumstances, are valuable thereunder, and are described for that reason.

6. Individual circumstances and conditions should be weighed carefully in connection with insurance decisions involved herein. What is sound practice for one company may be quite unsuited to another.

Consideration of all the contributing conditions and circumstances will indicate reasons for or against various changes in the insurance carried. Such factors should be weighed carefully to avoid the waste of unwarranted insurance or the dangers of inadequate protection.

MODERNIZED LUBRICATION
... Plant AND Product!
The correct oil film to each individual bearing... automatically
"International" Electric Bookkeeping and Accounting Machine
BIJUR
AUTOMATICALLY Correct LUBRICATION
● Far-sighted manufacturers . . . such as INTERNATIONAL BUSINESS MACHINES CORPORATION . . . are quick to sense the advantages of automatic lubrication. On the International machine, the Bijur Lubricator serves 90 bearings . . . helps to keep the machine at full operating efficiency. Again—in their production departments—they find it advantageous to use machines on which Bijur Lubricators are standard equipment. Write for Bijur Bulletin "D."
BIJUR LUBRICATING CORPORATION LONG ISLAND CITY, NEW YORK
853

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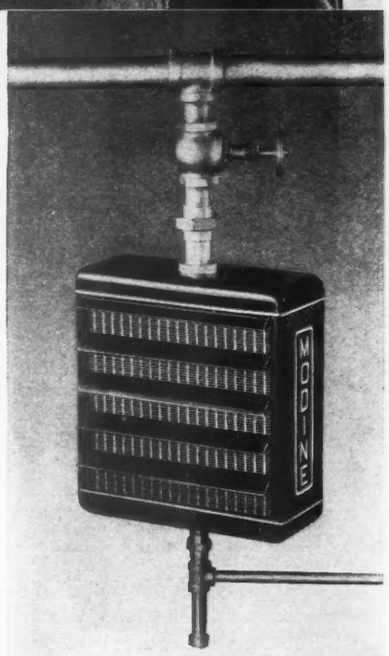
Civil War?

Denouncing the CIO movement as an attempt by John L. Lewis and his associates to establish a "labor despotism" in the United States, and warning that the movement is "a deadly economic plague creeping over the country," which will end in Civil War if it is not checked, Representative E. E. Cox, Democrat of the Second Georgia District, served notice recently on CIO leaders that their movement would not be tolerated in the South.

"I warn John L. Lewis and his

"All men are created equal"

BUT UNIT HEATERS ARE NOT



● There *is* class distinction among unit heaters. And Modine is in a class by itself. It has no superior. The product of pioneer heat transfer specialists . . . developed by years of research . . . its exclusive design and construction improvements make Modine the outstanding unit heater for every industrial and commercial use.

Modines are faster heating...deliver more heat...distribute it thoroughly. Even temperatures! No drafts! No cold spots! No waiting for heat on coldest mornings. Turn on Modines, heat is delivered immediately. No waste...off goes the switch, heat delivery stops. Save 25% and more on fuel.

The Modine condenser is *all copper*. Only Modine has *expansion bend* construction, permitting the condenser tubes to expand or contract *individually*, eliminating leaks. Only Modine has *velocity generators* . . . giving greater heat throw without increasing power requirements. Another Modine-patented feature, *direct-from-supply-line suspension*, saves time, labor and money in installation.

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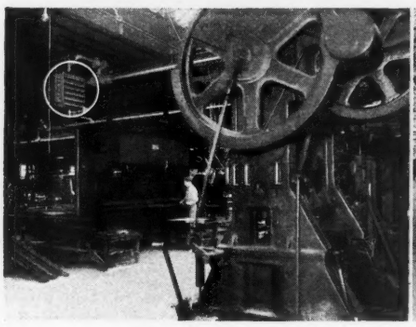
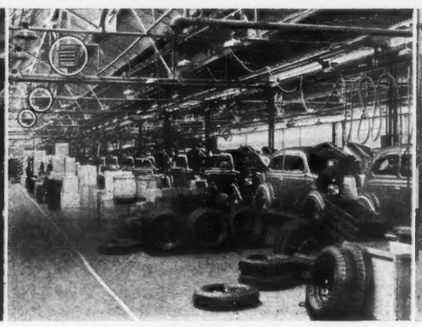
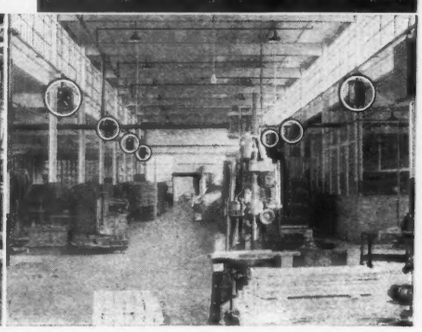
MODINE UNIT HEATERS

MODINE MANUFACTURING COMPANY
1730 RACINE STREET • RACINE, WISCONSIN

HEATING, COOLING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRIAL, COMMERCIAL AND RESIDENTIAL APPLICATION







Communistic cohorts," said Representative Cox, "that no second 'carpet-bag expedition' into the Southland, under the red banner of Soviet Russia, and concealed under the slogans of the CIO, will be tolerated.

"If the minions of the CIO attempt to carry through the South their lawless plan of organization, if they attempt to demoralize our industry, to corrupt our colored citizens, to incite race hatreds and race warfare, I warn them here and now that they will be met by the flower of Southern manhood, and they will reap the bitter fruits of their own folly."

Calling upon the National and State governments to cease aiding and abetting John Lewis and his associates in forming what the speaker declared is "a labor-political-communistic movement," Representative Cox said further:

"To continue to temporize with this movement will be to invite utter disaster for this nation.

"If we are for a moment to admit that millions of working men and women who are satisfied with their wages and their hours and their working conditions are to be summarily denied their right to earn their living without being impressed into membership in the CIO or in any other organization, we must be prepared to admit that this government is no longer capable of maintaining the constitutional rights and privileges of its citizens.

"If we are going to pursue a policy of encouraging defiance of the courts, of approving lawlessness and disorder, of condoning illegal seizures of entire industrial plants, and if we are going, as we already have gone, a dangerous step further, and use the armed forces of the States, and finally of the Federal Government itself to compel satisfied wage earners to submit to conscription into the CIO, then we must be prepared to admit not only that this government is no longer capable of maintaining the constitutional rights and privileges of its citizens, but that it has gone into partnership with the forces of lawlessness and disorder; it has joined hands with a labor despot; it has embraced communism in industrial relations."

The Georgia Representative declared that AFL represents "a labor democracy based upon a lawful and orderly procedure of collective bargaining to adjust capital-labor relations, while CIO believes in a lawless and disorderly procedure to force its own desired adjustments of capital-labor relations."

In support of his repeated assertion that CIO is communistic in its aims and is being led by avowed Communists closely associated with John L. Lewis, Cox included in his speech a list of the names and addresses of 249 CIO organizers, which showed 75 of the organizers to be members of the Communist Party and 46 others known to be communists; making a total of 121 of the CIO staff known to be committed to the work of overthrowing the American form of government.

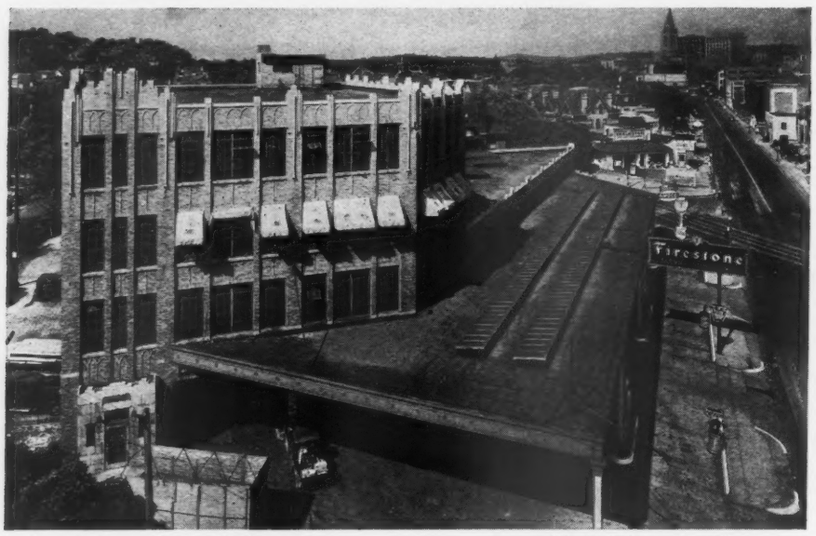
"Unless I very greatly misjudge my country and my countrymen, this menacing condition will not much longer be tolerated," the speaker said. "If the Federal and State and County officials do not prove faithful to their oaths and duty, if this sinister movement is not brought within the bounds of law and order, this country will witness an uprising of its outraged citizens in protection of their industries, their businesses, their employment, and their homes. And that will be Civil War!"

•

Next, the Closed Shop and Check-Off

The signing of a contract with the CIO is but the first step to the closed shop and the check-off as John Lewis and other CIO leaders have publicly announced.

The closed shop means that no one can work in a plant where such system is in effect, unless he first joins the union. It is an arrangement between an employer and a labor union which denies the right of the individual worker to make his own choice



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"Most roof miles per dollar" is the measure the Firestone Tire and Rubber Company uses in selecting their roofs. The above illustration shows their Pittsburgh, Pa. branch office and service station. Like nine other Firestone buildings (including two in Liberia, W. A.), its Holorib Insulated Steel Deck affords the utmost in roof protection.

The long life and performance of a Holorib Steel Roof amply repays such confidence. Holorib Steel Deck forms a perfect roof sheathing, strong but light in weight. Insulation and waterproofing laid over this steel deck insure a leak-proof roof that gives positive weather control inside the building.

A Holorib Steel Roof is a time and money saver. Quickly erected in almost any weather, it speeds completion of the building, often reduces structural requirements. Cost per year of service makes Holorib one of the best roof investments possible. Write for complete details.

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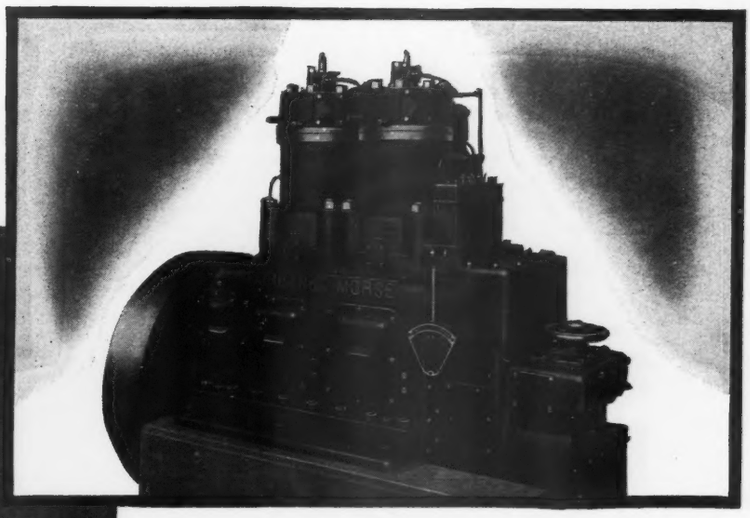
CONSTANT OPERATION IS HEAVY DUTY

. . . regardless of horsepower



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F-M 42 DIESEL FOR THE HEAVY-DUTY "Little" JOBS

2-Cyl.—60 HP. 3-Cyl.—90 HP.

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In design, operation, sturdiness, ability to stand weeks on end of continuous labor, the New F-M "42" is the little brother of the world known F-M "32." In a 60- or 90-hp. "package," it brings you all of the F-M "32" advantages—lower fuel costs, unsurpassed efficiency, back-flow scavenging, the ultimate in simplicity of design, operation, and maintenance.

Learn more about this latest development of the engineers who have built the world's largest total of Diesel horsepower. Write for Bulletin 4200-30. Address Fairbanks, Morse & Co., 900 S. Wabash Avenue, Chicago, Ill. 34 branches at your service throughout the United States.

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Diesels

as to whether he wishes to belong to a union or not.

The check-off means that the employer agrees to take the union dues out of the pay envelope of the worker. He forces the worker to pay his union dues. The union dues become a first tax. The butcher, the grocer, and the doctor may go unpaid but not the union. We believe a worker's money is his own personal property to do with as he chooses. If he wants to contribute to a labor union, that's his business; if he does not want to contribute, that's his business. We believe that our employees have a right to join any organization of their own free choice, free from coercion or intimidation from any source. Republic does not intend to be a party to anything that is designed to impose a tribute upon its employees for the right to work.

Now let me state a few fundamental conclusions which I have reached about the CIO.

First: The CIO has denied to free American citizens who refuse to pay tribute to it the right to work.

Second: The CIO encourages and promotes violence and disregard of law. If this is done under instructions and approval of its leaders, it amounts to a confession on their part that they are deliberately adopting the methods of force and terrorism, which have proved so successful for the dictators of Europe. If this is done without their approval and occurs because they cannot control their own men, it is a confession that the CIO is an irresponsible party and that a contract with it would not be worth the paper upon which it was written.

Third: The CIO is associated with communism, many of its leaders and organizers are avowed communists. The *Daily Worker*, official newspaper of the Communist Party of the United States, gives the CIO its full support. Can any organization which welcomes the support of the international communist party still claim that it adheres to the principles of democracy?—*T. M. Girdler, Chairman of the Republic Steel Corporation, in a statement before the Senate Post Office Committee.*

•

Costly Experiment, Says Green

"No hostile employer in America has done the cause of organized labor more harm than those who formulated, executed, and administered the policies of the Committee for Industrial Organization during the past eighteen months."

Thus William Green, AFL president, in a recent statement.

"We cannot permit all organized labor to be penalized because of the stupid mistakes of the CIO," he added. The complete statement follows:

"It now becomes certain that the steel strikes at Chicago, Cleveland, Johnstown, Youngstown, Canton and other cities are lost. That means that the Committee for Industrial Organization failed to meet its major test successfully.

"The strikes exacted their toll in human life and human suffering. No one can correctly measure the extent of the distress which individuals and whole communities have suffered and will suffer.

"The hosts of labor are truly sorry because of the failure of the costly experiment and its tragic outcome. They regret that thousands of workers were persuaded to sacrifice themselves as victims of ill-advised and untimely strikes. Resentment and disappointment among these workers is bound to follow.

"The query now is, What steps will now be taken by the one who formulates the policies of the Committee for Industrial Organization? He ordered those employed in the mines of the independent steel companies to strike in sympathy with the steel workers. Those workers are idle now for the alleged purpose of preventing the independent steel companies from securing coal.

"Now that the steel mills are in operation, will he call out on strike those mine workers who are employed

. . . lower handling costs always mean greater production and increased employment

NO MATTER what you do with the figures, the final answer is always the same, lowered material handling costs are always beneficial to both industry and labor. Industry through cost reductions that invariably result in wider markets, volume production, and greater profits. Labor through increased employment and higher wage scales.

The Jervis B. Webb Company build and furnish every type of conveyor . . . and offer skilled engineers to combine the proper types for greatest cost reduction.

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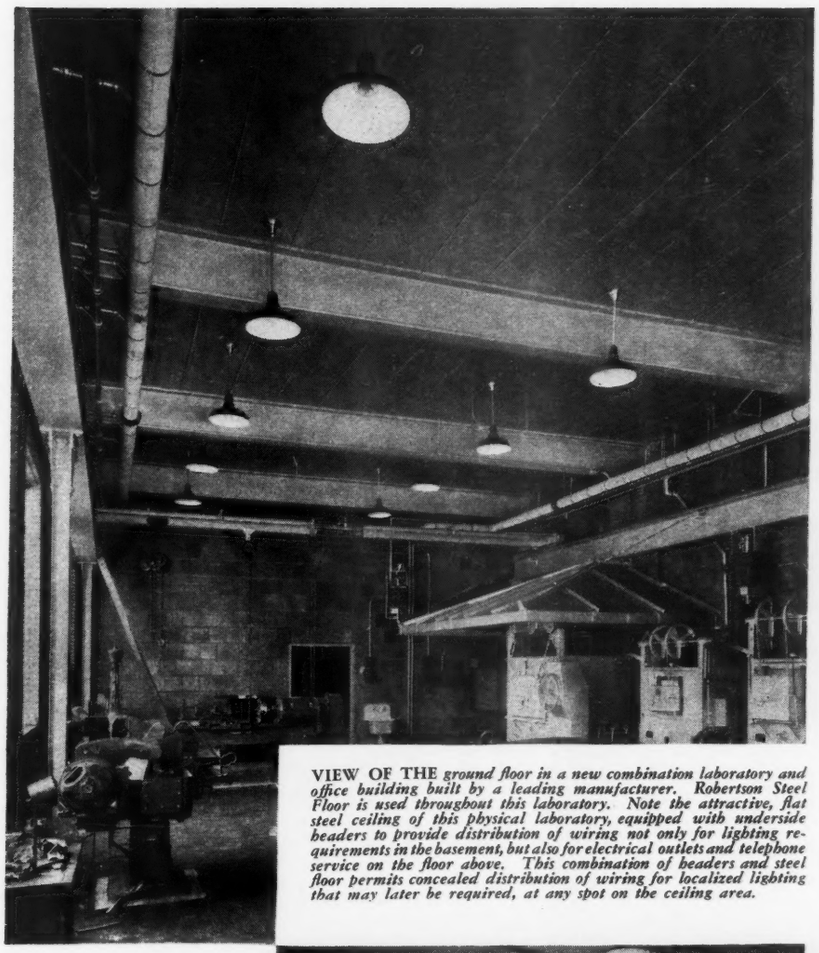
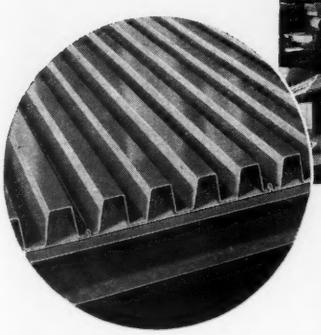


VIEW OF THE *ground floor in a new combination laboratory and office building built by a leading manufacturer. Robertson Steel Floor is used throughout this laboratory. Note the attractive, flat steel ceiling of this physical laboratory, equipped with underside headers to provide distribution of wiring not only for lighting requirements in the basement, but also for electrical outlets and telephone service on the floor above. This combination of headers and steel floor permits concealed distribution of wiring for localized lighting that may later be required, at any spot on the ceiling area.*

A TYPICAL OFFICE *area in the laboratory, where steel ceiling and steel beams have been economically painted to provide a clean, attractive appearance.*



THE new Robertson Steel Floor offers advantages found in no other single type of floor construction. Unusually strong, light in weight and compact in structure, it nevertheless can carry greater live loads than the ordinary floor. It reduces fire, accident and corrosion hazards, both during and after construction. It provides a safe, solid surface upon which to work immediately it is laid. Installation is quick and easy—ideal for remodeling work where every minute taken out of operating time counts heavily. Often, Robertson Steel Floor makes it possible to remodel without disturbing normal operations within a building.

Vitally important, too . . . this floor offers electrical advantages revolutionary in scope. New floor outlets may be cut in at any time—in any position desired. Since each hollow cell can be used as a protected wireway for electrical distribution, the most radical changes in equipment or usage can be met with a minimum of trouble and expense.

The unique structural and electrical qualities of the Robertson Floor make it ideal for use in factory buildings of all kinds, including plants, laboratories and factory office buildings. Here are floors that bring extra dividends in long years of safe service . . . absolutely free of maintenance costs!

Comparison will convince you that no other floor combines so many marked advantages. Specify "Robertson Steel Floors" when you build or remodel . . . and bring your factory a new and better kind of floor performance. Write today for complete information. H. H. Robertson Company, 2005 Grant Building, Pittsburgh, Pennsylvania.

• ROBERTSON STEEL FLOOR SYSTEM

at mines where the steel companies will now buy their fuel supply?

"He is now confronted with the problem of carrying out his threat to call miners on strike who are working under contract in mines where coal will be mined and shipped to independent steel companies, or directing those employed at mines owned by said independent steel companies back to work, defeated and demoralized.

"There are two outstanding reasons why the strikes were lost.

"First, because only a minority of the steel workers employed at the plants involved were organized when the strikes were called. Apparently the CIO leaders are strong for minority action and minority control. They sought to win a major battle with only a corporal's guard in action.

"The CIO was not defeated because the small number of victims who participated in the strike lacked heroism or courage, but simply because the overwhelming majority of the steel workers refused to join the CIO and participate in the strike. The essential requirement of a strong and complete organization of workers, preliminary to the calling of a strike, was completely ignored.

"Second, public opinion was aroused because of the violent policies pursued by the CIO in automobile and steel during the past year. It became openly hostile. Here, again, the power and force of public opinion is emphasized.

"The leaders of the CIO may as well make up their minds that they cannot win strikes against which public opinion sets itself. The reaction of public opinion against the CIO and CIO methods, is reflected in the creation of vigilante organizations in different cities, in the enactment of legislation such as the new Labor Relations Act in Michigan, and the threat of repressive legislation in other States, as well as in the Congress of the United States.

"As a result of the creation of hostile public opinion against the CIO, the American Federation of Labor must intensify its fight against the enactment of repressive legislation such as compulsory arbitration, the incorporation of trade unions and the restriction of the rights which organized labor may exercise both in carrying out contracts and in the inauguration and prosecution of justifiable strikes.

"We cannot permit all organized labor to be penalized because of the stupid mistakes of the CIO.

"The violation of agreements, the seizure of public property, violence, riots and uprisings can have no place in the social, economic and industrial life of America. No union of workers who resort to the use of such methods can succeed. Failure for those who pursue such a policy is inevitable.

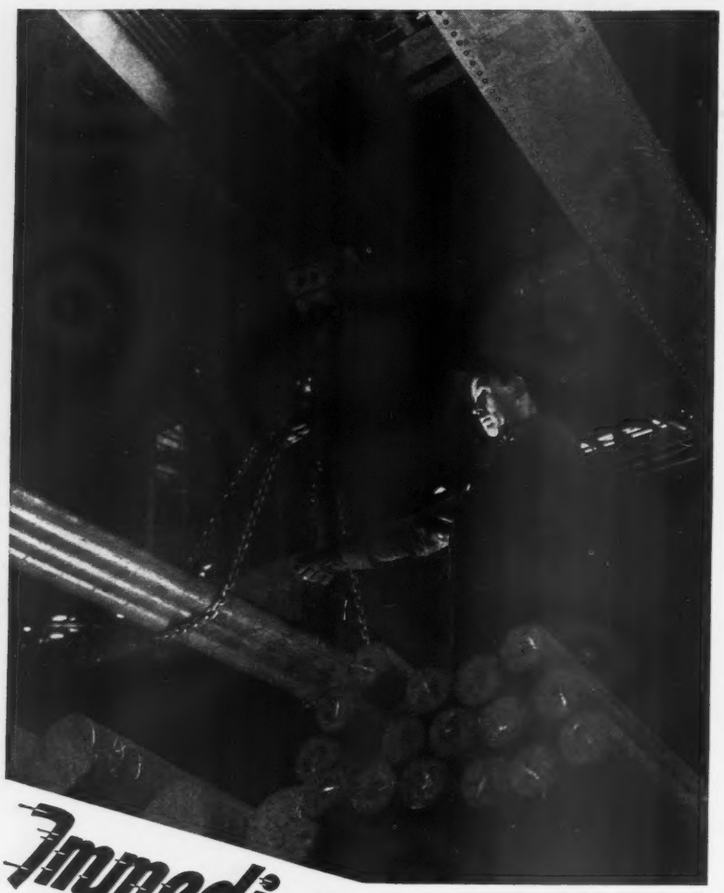
"Workers of the United States understand this to be true. They are willing to strike and fight for higher wages and improved conditions of employment, but they will do so as law-abiding people through the exercise of every moral, legal and economic right to which they are entitled, in an orderly way and in conformity with the laws of the land."

•

Wages-Hours Bill Penalties

Upon looking at the wage and hour provisions of the two bills which you have before you, I have at once been struck by the penalties. There would be enforcement not only through court action to compel compliance, and fine and imprisonment, with offenses multiplied in an extreme way, but hidden taint would be placed on ordinary commodities, and it would be made unlawful for a person who bought these foods in perfect faith, and without knowledge of the taint, to ship them in interstate commerce. For such shipment he would seem to become liable to penalties; for there seems to be nothing in the penalties about his knowledge, such a provision occurring only in the penalty for false statements and entries.

Injecting such uncertainties and liabilities into commerce would be a most serious thing. I venture to express an opinion that business men



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• There is hardly a product in the steel and allied lines that you cannot secure quickly and economically from the nearest Ryerson plant. Stocks that include more than 10,000 sizes and kinds of steel and allied products . . . modern handling and cutting facilities . . . and special dispatching methods assure accuracy, dependability and speed. When you need steel, call on Ryerson. Ten plants stand ready to meet your requirements.

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RYERSON STEEL-SERVICE

but still... it would have been cheaper to give him GOGGLES

It may be only the flick of a spent chip from another machine . . . and the worker may laugh it off, return to work without reporting it. But sooner or later some of these minor accidents will cause trouble — slow infection, an injury from home first aid, perhaps a dormant eye-disease aroused by irritation. For all of which *you* foot the bill, with extra charges for lost time and production.

Prevent *all* eye-injuries. Protect against all eye-hazards — especially the "unimportant" ones — with the right AO goggles for every man and his job. And to make sure you spot them all, call in your good neighbor, the local American Optical representative. His plant-survey experience will prove a great help to you. No obligation at all. Write.

THE F-3100 FUL-VUE GOGGLE (patented) provides workers all-day-long protection and comfort. High-up end-pieces give unobstructed vision at the sides. Self-adjusting nose pieces fit themselves comfortably to the sides of the nose. 6-Curve Super Armorplate Lenses (patented) offer greater resistance to impact than other lenses used in safety goggles.

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Manufacturers, for more than 100 years, of products to aid and preserve vision. Factories at Southbridge, Massachusetts. In Canada, Consolidated Optical Co., Ltd. Branch offices in all principal industrial centers.

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generally will feel there is injustice to perfectly innocent persons, and a general clog on business, in provisions of this kind. It would seem that if an employee of a manufacturer, without the manufacturer's knowledge or consent, worked beyond the maximum hours set by a federal agency for that kind of establishment, the whole product of the manufacturing establishment during the three months would be so tainted that innocent purchasers without notice would commit unlawful acts by reshipping in interstate commerce. The taint caused by the bill would seem to disappear only when goods are in the hands of the ultimate consumer.—*George H. Davis, President of the Chamber of Commerce of the United States, testifying before the joint Congressional Committee on Labor.*

Another Way to Figure Delay Per Cent

In his article, "Only One Way to Figure Delay Per Cent," in the June issue, Professor Henning compares two methods of figuring delay per cent, one of which he assumes to be the only right way of making the calculation, whereas the other is the incorrect method of making it.

Although Professor Henning's figures are correct, his way of figuring delay per cent is not the only way, but one of the correct ways. In fact, I think that the way of figuring it demonstrated in the following is more easily comprehended by the time-study man and as a matter of fact I believe he would prefer it.

The misconception of the delay percentage creeps in when one forgets the basis upon which the percentage was established and shifts to another basis to complete the calculations.

It is easier when we view the matter graphically.

Now if S equals standard time and D represents delay time, D is definitely a percentage of S. If we let this percentage be A,

$$A = \frac{D}{S} \times 100\% \qquad (1)$$

D is now established as a certain percentage of S, which is by no means incorrect. To calculate standard time this must be kept in mind when we write—

$$S = C + \frac{(S \times A)}{100} \qquad (2)$$

or transposed—

$$S = \frac{C}{1 - \frac{A}{100}} \qquad (3)$$

and consequently standard output P per hour becomes—

$$P = \frac{60\left(1 - \frac{A}{100}\right)}{C} \qquad (4)$$

It will be seen that it is not incorrect to refer the percentage of delay to standard time as brought out in equation (2).

A More Logical Application

Therefore, I consider it misleading to state that time delay in per cent could only be applied to the cycle time. Equation (3) will make it appear so finally, but basically the delay per cent was not applied to cycle time C but to standard time S. I believe that it is more logical to apply delay per cent to standard time for the reason that the whole mathematical relation can be visualized better from this deduction.

Using Professor Henning's figures in the foregoing equations, we obtain the same results he did.

$$A = \frac{80}{480} \times 100\% = 16.67\%$$

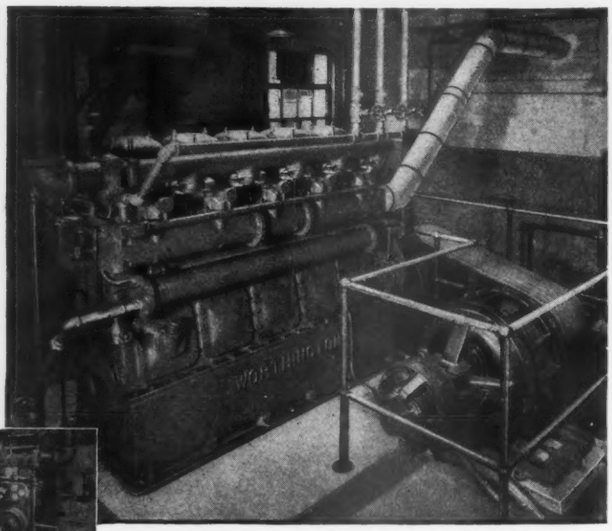
With C 1.25 min.—

$$S = \frac{1.25}{1 - \frac{16.67}{100}} = 1.5 \text{ min.}$$

$$P = \frac{60 \times 0.833}{1.25} = 40 \text{ pieces per hr.}$$

J. DECKER
Cincinnati Milling Machine Company
Cincinnati

At **Positive Lock Washer Company's** *Newark, New Jersey, plant, this modern Diesel power installation is completely Worthington. The 150-hp. Worthington Diesel is driving the generator through a Worthington Multi-V-Belt Drive. All auxiliary equipment is by Worthington.*



Another Worthington Diesel is contributing substantially to profitable plant operation

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IN some plants, power costs have been cut to less than half of former costs... thus directly augmenting profits.

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Timepieces contrived by guild watchmakers hundreds of years ago still keep perfect time today—because the guild craftsman gave his work the loving care of a doting parent! Every individual part received his unflagging, minute attention. Precise . . . Perceiving . . . Persevering . . . the perfection of the finished product was his only goal!!

Because of their guidance by this same basic principle, YALE has maintained undisputed leadership in the chain hoist field for three-quarters of a century!!

And the supreme quality of YALE CHAIN HOISTS reflects their strict adherence to the ideals of the old guild craftsmen!! Made of the finest materials throughout, any one of ten different points would immediately stamp the YALE CHAIN HOIST as the best that money could buy!!

In constructing these superior hoists, safety was given paramount consideration! Every YALE hoist is equipped with Steel Safety Hooks . . . Hooks drop-forged from Special Steel to give visible warning when over-strained . . . Hooks which, if overtaxed, open slowly—without fracture—before any other part of the hoist is strained!!

This is only one of the ten features that has made YALE the dominant factor in the CHAIN HOIST field that it is today!! Any YALE distributor will be glad to tell you all about the other nine!!

CAPACITIES: 300 POUNDS TO 40 TONS

STEEL SAFETY HOOK

The "safety valve" of the Yale Hoist Drop-forged from special steel, it opens slowly, without fracture, before any other part of the block is overstressed — protecting the mechanism, the load, and workman.

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USED BY 8 TRUNK RAILROADS

135,642 Sq. Ft. of Installed Direct Radiation Under Control in 15-Story, Block-Square Building

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Owned by The Port of New York Authority, this Commercial Building, with 42 acres of floor space, presents under a single roof all the heating problems of a large merchandising and manufacturing community.

With a single Outdoor Thermostat to vary the steam supply to the entire system and five Variators to permit modification of steam delivery to meet the requirements of each heating zone, the Webster Moderator System has maintained desired temperatures in business offices, lofts and manufacturing sections on 14 floors above the ground floor.

The Port of New York Authority Commercial Bldg., 8th and 9th Avenues, 15th and 16th Streets

During February, 1937, more than four years after the original installation was made, the Webster Moderator System demonstrated its economy by heating the Port Authority Commercial Building with .036 lbs. of steam per degree day per thousand cubic feet of contents.

Abbott, Merkt & Co., Inc., well-known New York firm of Architects and Engineers, specified the Webster Moderator System for this large installation. Jarcho Brothers, Inc., of New York, acted as heating contractors under the Turner Construction Co., the general contractors. There is a total of 135,642 square feet of installed direct radiation under control.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

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Letters from the Editor

The following letters were written by the Editor in reply to specific inquiries. They are published here in the belief they will be of interest and help to many of our readers.

Dear Professor A———:

In response to your letter of June 18th we find that durable goods production reached a low of 25 in August 1932, while non-durable goods went to 79 in June 1932. These are Federal Reserve Board figures, based on the 1923-25 averages.

I might add that, according to the National Industrial Conference Board, industrial production fell to 53.8 in 1932, on the basis of 1929 = 100. Unfortunately I do not have their figures for durable and consumption goods. If you want them, I'd suggest that you write the Conference Board at 247 Park Avenue, New York City.

Dear Mr. B———:

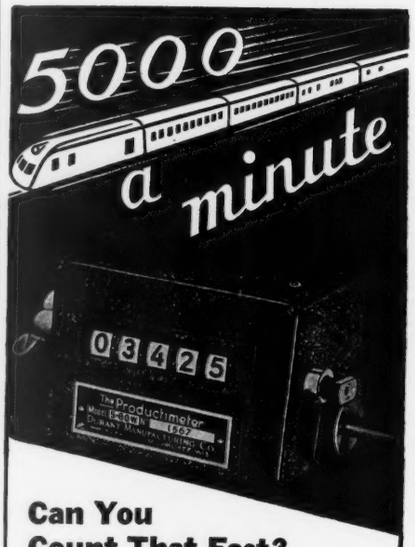
In reply to your letter of June 29th, the data you wish regarding the weight of moisture in saturated air can be obtained from the Bulkeley Psychrometric Chart, which is published by the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York, N. Y. It is part of the 1937 edition of the A.S.H.V.E. Guide.

If you do not have a copy of this Guide, you will probably be able to obtain one at a local library. It is my understanding that the Bulkeley Chart can be purchased separately from the A.S.H.V.E. at 25 cents.

Dear Mr. Y———:

As a reply to your letter of June 13 we are very glad to send you a reprint and what tear sheets we have of the articles mentioned in the two bibliographies in "New Methods That Cut Factory Costs." The articles missing are out of stock and you can look them up when you get to some large library that keeps a file of *Factory*. Or, if you like, you can obtain copies of the complete issues from the H. W. Wilson Company at 960 University Avenue, New York, N. Y.

No, McGraw-Hill does not publish a bibliography on motion study, methods analysis, etc. You can get just the thing you want from the American Society of Mechanical Engineers, 29 West 39th Street, New York City. They are about to bring out a new edition of their "Bibliography of Management Literature." The old edition covers articles published up to January 1931.



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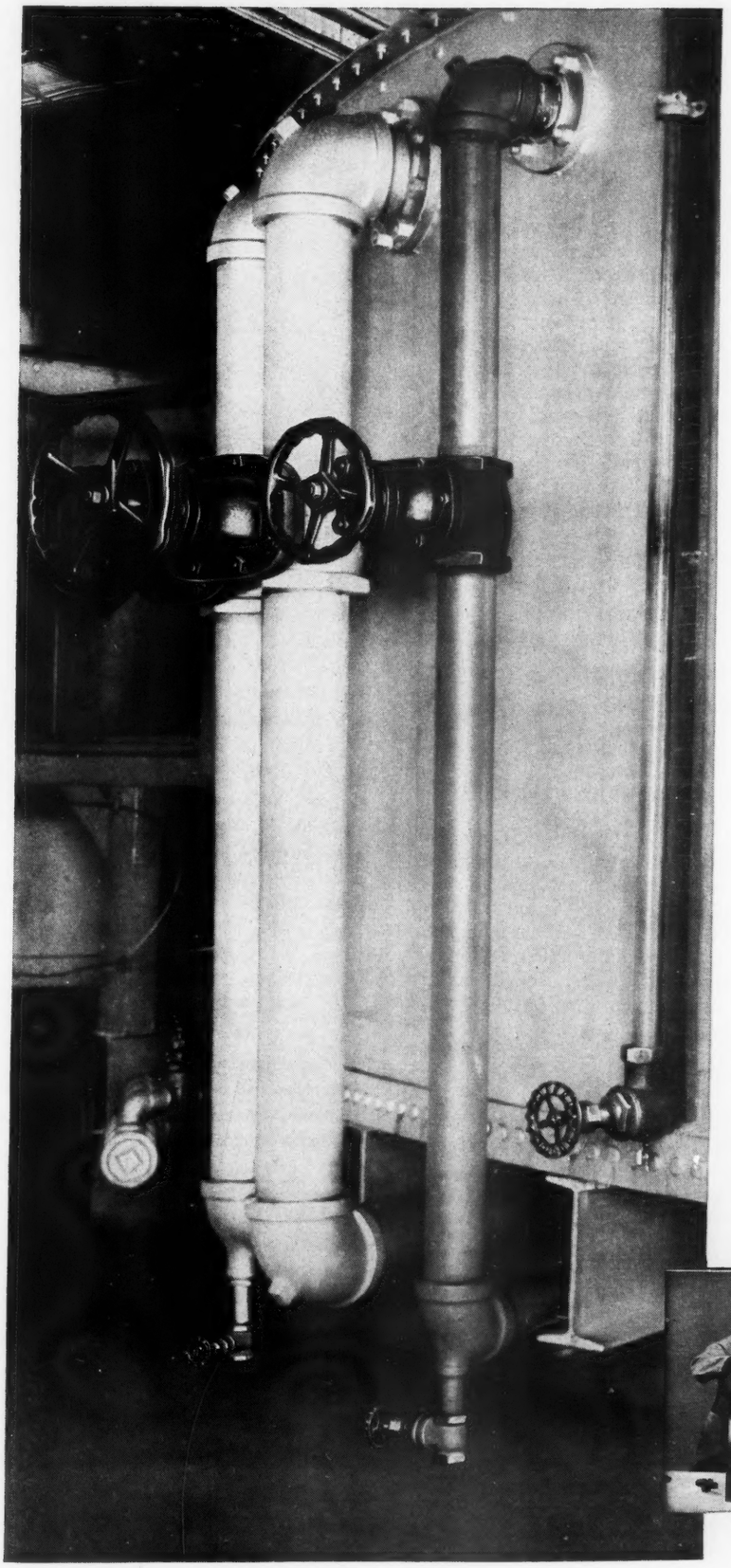
"Use Jenkins on Large Lines, too"—



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IN their own cost sheets valve users find evidence that it pays to buy IRON valves as carefully as bronze. Trouble with valves on large lines proves to be more expensive, as a rule, than on small lines. More time and labor is required to take down large valves. Parts and replacements cost more. Lengthy service interruptions may be necessary. Jenkins IRON Valves... *built for trouble-free performance* like the famous Jenkins Bronze Valves... are bound to produce economies.

When valve users check prices on IRON valves they often find that Jenkins quality can be obtained for much less than they had believed. Actually, a "Jenkins" sells at the standard price for good valves.

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Write for full details of the Airtherm line including the AIRBLANKET, at once.

AIRTHERM MFG. CO.

1470 S. VANDEVENTER ST. LOUIS, MO.

Getting Along with the Union

(*Continued from page 55*)

responsibilities and duties and rights under the collective bargaining set-up, they were shown what burden each man must shoulder, and the bounds beyond which he may not go. They learned, for example, that there is only one man or committee with which any supervisor may work or bargain or dispute, that every question must come through the precise channels set up for it, and through no other.

It was essential that the foremen be impressed with the importance of handling everything in channels, and also that they reduce everything to writing so that the record on any individual case may be complete. Likewise, it became far more important than ever before that the supervisor record all reprimands, violations of rules, and so forth, against the time when it might be necessary to discharge a man—for a discharge is a sure-fire grievance, and it is well to have enough information on hand to convince the union representatives that the individual deserved firing long before the ax actually fell.

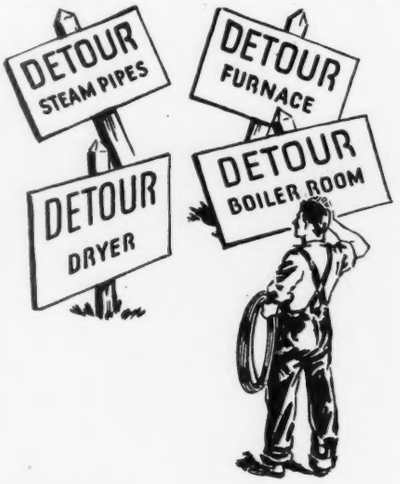
Asks Himself Three Questions

The rule of thumb which the supervisor was taught to apply is in the form of three questions. (1) Is the problem being presented by persons responsible to me? (2) Is the problem one which affects an individual or group under my jurisdiction? (3) Have I the authority to say yes or no to this problem?

If the answer to all three questions is "Yes," then the supervisor is not only free to assume responsibility, but also is definitely expected to settle it if he can, and to inform his immediate superior of the problem and his actions.

Summed up, it is the company policy that the supervisor's position under collective bargaining is, within the plant and during working hours, full responsibility for those persons working under him. No one other than the supervisor's superior has any authority to interfere with this relationship.

Situations or problems which arise among the working forces of any department are at all times to be handled through the proper lines of authority. In brief, under collective bargaining the tactful,



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If the perplexed juice jockey could short cut these detours for heat he'd save a lot of time and a good part of his coil of wire. Boiled down into figures it would represent a pretty good dividend in material and labor savings.

And you can do just that with your wiring if you use Rockbestos *asbestos insulated* wire. It can be short cut over steam lines, boilers, furnaces, ovens and other hot spots where you need a *permanent installation* because it's built to take the heat. Use it on your *hot* wiring problems for a triple saving . . . in footage . . . labor . . . and elimination of expensive replacement.

Rockbestos asbestos insulated wires, cables and cords are not only heat-resisting, but have ample moisture resistance and are not deteriorated by oil, grease, corrosive fumes . . . or time. Over fifty different constructions. Send for samples and a 10-D Catalog. Rockbestos Products Corporation, 857 Nicoll St., New Haven, Conn.

ROCKBESTOS A.V.C. POWER CABLE
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Also refer to Electrical World Buyer's Reference Number of Dec. 19, 1936

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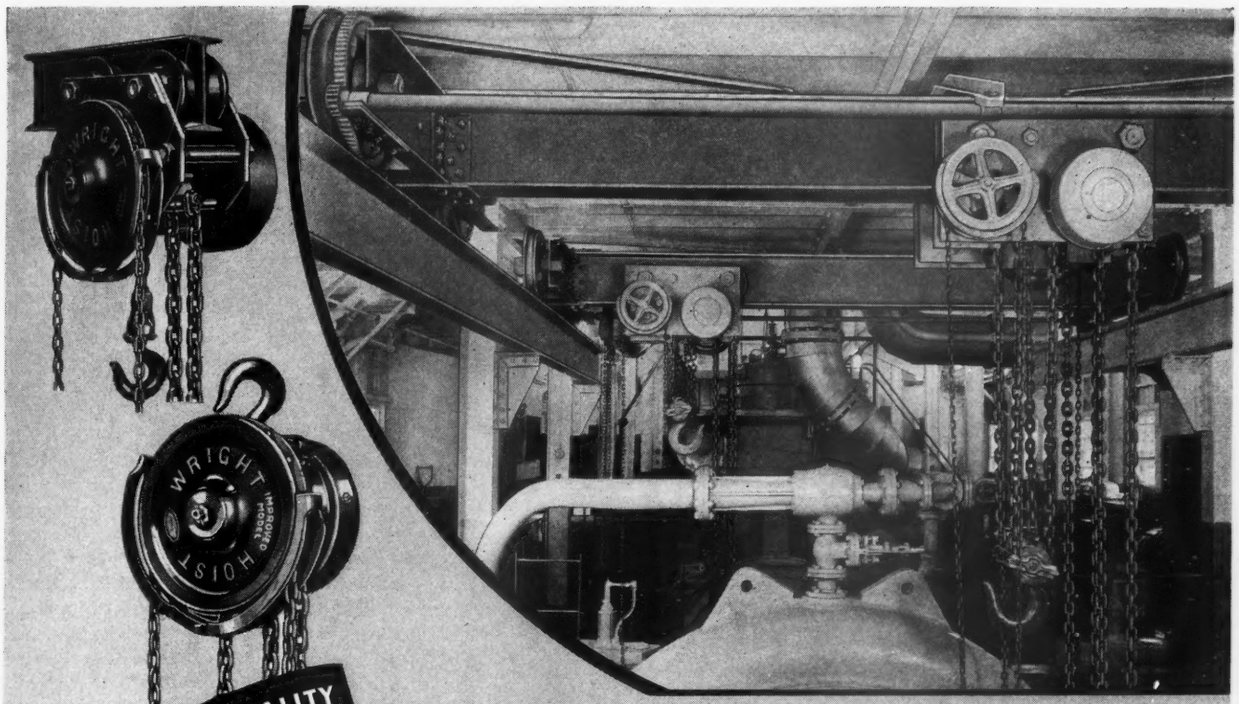
the wire with permanent insulation



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The Hi-Way Hoist on Wright Hand Traveling Cranes gives you the high hook lift you have always wanted for those "clearance" jobs which heretofore have required expensive rigging, time and trouble.

The Wright Hi-Way Hoist incorporates all of the 21 fine mechanical features of the Wright Improved High Speed Hoist. For instance, it has the zinc "All-Weather" coating. It has precision bearings at all key points for faster handling with easy operation; also, the safety load chain guard.

The Wright Hi-Way is from the complete line of Wright Chain Hoists which includes 14 different models in a wide range of sizes. Before you select a hoist, investigate the Wright Line.

Write, or ask your jobber's salesman for the new Wright Catalog.

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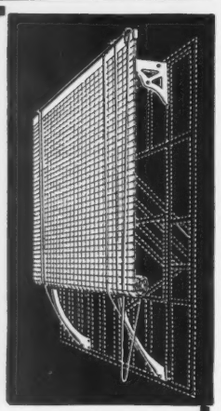

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RA-TOX are wood fabric shades, designed especially for steel sash with swing ventilators; yet, efficient on all types of both wood and steel sash. The most successful and largest factories in America are RA-TOX equipped. Look into the advantages of RA-TOX for your plant . . . easy to regulate . . . strongly built and durable . . . lasting for at least 20 years.

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thoughtful type of supervisor or foreman has almost the same position as he set for himself before collective bargaining. The arbitrary or domineering type, never popular but occasionally represented, has had to change his manners.

Experience also indicates that in the earlier stages of collective bargaining, there will probably be a greater volume of grievances, and perhaps a less significant average of grievances, than should arise a little further along in the relationship. There is in any large plant a sizable proportion of all employees who have on their minds some wrongs, real or fancied, which have been with them for years and which they never got far with. Now, with a mechanism all set up to serve them, these old familiar plaints are coming to the surface along with a great many new complaints.

Many, perhaps most, of the grievances are small or based on misunderstandings. Others, to the surprise of supervision, turn out to be pretty substantial and real and perhaps of long standing. It seems likely that the very fact of getting all of these grievances aired should lessen the internal tension of the working force. Moreover, in a good many cases the union representatives who meet with management get a rather clear picture of the bias of the complaining individual and settle the grievance accordingly.

So, while collective bargaining has unquestionably taken a lot of time and attention from the management, much of it on matters which do not deserve the expenditure, it is probable that this will turn out eventually not to be all loss. Certainly the record of comparative peace between company and workers testifies the effectiveness of the procedures which have been set up for working together.

"Amend the Wagner Act" Says Management

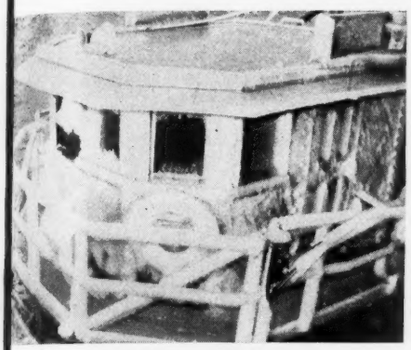
(Continued from page 51)

Superintendent—Indiana. "Wagner Act should be junked and a sensible labor policy embodied in another act."

Works Manager—New York. No. 13—I believe labor should be governed by code in a manner similar to our accident, fire, and state labor codes; i.e., regular inspections, and a per capita charge. Labor unions might act as

WAVE OF SUB-ZERO TEMPERATURES HALTS TRAFFIC-PARALYZES INDUSTRY

American Blower Unit Heaters Keep Production Moving



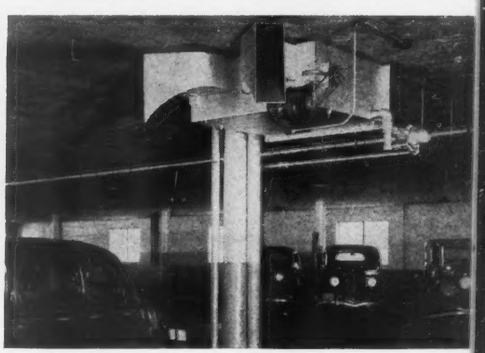
1. **Coming soon** . . . chilly days . . . sub-zero temperatures. The ice covered trawler is a sure sign of approaching winter. Check your heating equipment now.

2. It's here with a vengeance . . . traffic tied up . . . production slowed up or stopped in thousands of plants . . . costs "upped" due to "cold delays". Poor heating equipment just can't "take it".

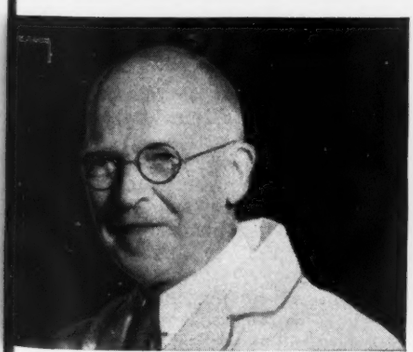
3. Your plant too, can profit in weather like this by using American Blower Unit Heaters. More heating contractors recommend them than any other type.

4. No lost time in this plant . . . Venturafin Unit Heaters heat up quickly . . . effectively . . . regardless of weather. Over 125,000 units already in use.

5. C. E. Lambert, plant manager, says "After a careful study, we bought American Blower Units because of their sturdy construction and ability to heat 'tough jobs'. We recommend them heartily."

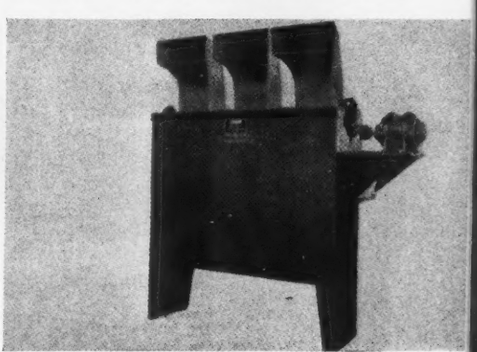


6. Keeping transportation equipment in operation in sub-zero weather is a job. But American Blower Unit Heaters do the trick. Note Sirocco Unit at ceiling.



7. S. D. Miller, garage operator, says "We have cold cars and zero days to contend with. American Blower Heaters are the best performers I have ever seen."

8. Look before you buy Unit Heaters. The American Blower Venturafin Unit Heater shown above *costs no more than ordinary heaters,* yet it is sturdier, better built, more effective.



9. The Sirocco Unit Heater, too, offers many unusual features and advantages. It is particularly effective in large, high ceiling industrial buildings. Write for data.

American Blower Unit Heaters are carried in stock everywhere for immediate delivery—they cost no more than ordinary heaters. Ask your heating contractor for them.

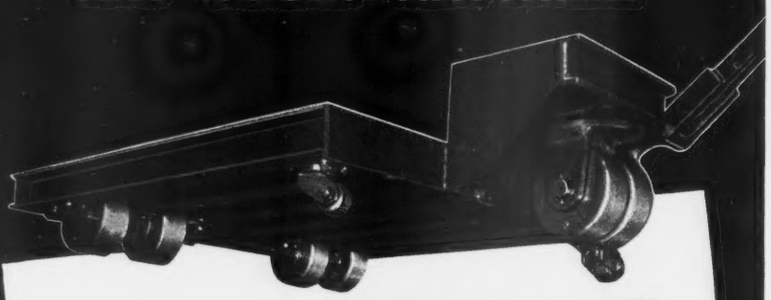
AMERICAN BLOWER CORPORATION

Division of American Radiator and Standard Sanitary Corp. • 6000 Russell St., Detroit, Mich. • Canadian Sirocco Co. Ltd., Windsor, Ont.

AMERICAN BLOWER
INDUSTRIAL UNIT HEATERS

Sure can take it!

ANY WEIGHT—ANYWHERE

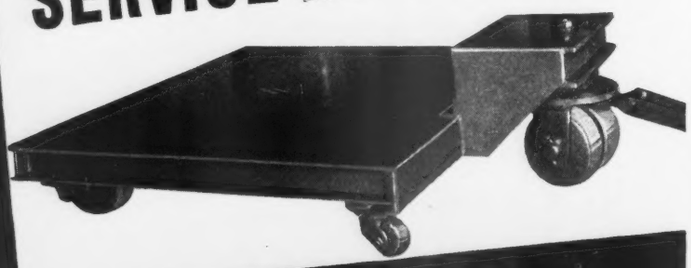


HANDLES 30-TON LOAD WITH THE GREATEST OF EASE

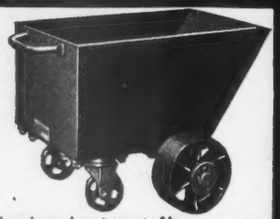
The 6' x 6' steel platform . . . only 12⅞ inches above floor level . . . rests on a beamed under-structure with the stamina of a railroad bridge. Originally engineered for handling dies in the plant of a leading automobile manufacturer . . . this truck takes any concentrated load up to 30 tons and rolls it easily on friction-free, full bearing 12x5 wheels. It's a broad-shouldered brute that thrives on heavy work and rough treatment. Write for detailed specifications and performance record in various fields.

No matter what your materials-handling problems and needs, there's probably a field-tested Service "special" that will meet them. Note typical Service "specials" illustrated below. They handle unusual jobs unusually well. Check their application to your hauling problems.

SERVICE CASTER & TRUCK CO.
505 N. Brownswood Ave., Albion, Mich.



Developed for rapid handling of heavy packages. 30" x 60." The three sides extending up 36" above platform are of 16-gauge perforated metal.



This small Dump Truck slips into tight corners and under exhaust-spout of low machines. 10-gauge steel hopper measures 12"x 18" at mouth and 12"x 12" at bottom.

the governing body (under restrictions and responsibility). In this case I would recommend the 'check-off.'"

Assistant Manager — Pennsylvania. "Secretary of Labor should be a *capable* person who would be absolutely fair both to employer and employee. Our present Secretary of Labor at Washington has surely betrayed her trust and should resign.

"Sit-down strikes should be illegal and persons engaged in same should be amenable to the law, the same as any one who takes possession of property illegally.

"Government employees, C W A, PWA, etc., all relief workers should not be allowed to form any organization which can call a strike against the government or a government project."

Superintendent — Nebraska. "Labor unions should be held responsible for any destruction of property and should be penalized for any unlawful acts. Wagner Bill is too one-sided."

Superintendent — California. "Regardless of the intentions of the author of the Wagner Act, it means rule by force, and the chaotic economic condition that is sure to result will play into the hands of the self-aggrandizing politicians who attempt to establish a Hitlerite form of government. The Wagner Act is not necessary. It is dangerous and a deterrent to further growth of the United States. It should be repealed."

General Superintendent—California. "Picketing of plant should be forbidden to all except employees of that plant."

Personnel Manager — Indiana. "I am very much in favor of No. 3, in which case No. 7 would not be necessary.

"In all fairness to union members there should be public accountings made of receipts and disbursements.

"It seems that if governmental protection be afforded to non-strikers the purpose of the act would be nullified.

"The act should be amended to plug up the loophole of irresponsibility on the part of labor and give some protection to the employer and to the public at large.

"Under the act at present, all responsibility of compliance rests with the employer, and no definite rules of compliance are laid down for labor."

Time-Study Supervisor — Pennsylvania. "What we need is more Tom Girdlers and less rotten politics.

"Observations made, since the company recognized the CIO, disclose that the majority of the leading CIO members expect to get the maximum wages for the minimum production. The path of a time-study man is never rosy, but since the CIO came on the scene it has been a path of thorns."

Oxweld* MP-5

Acetylene Generators *offer New Operating Economy*

THE new *Oxweld* "MP-5" line of medium-pressure acetylene generators gives you a choice of three sizes to deliver 1,000, 600 or 300 cubic feet of acetylene per hour. Each size embodies accurate pressure control so that sudden and wide changes in acetylene demand cause little or no fluctuation in line pressure. Each size offers high efficiency—ready accessibility of parts—speedy emptying and recharging—and simplified maintenance.

A Linde representative will gladly show you how an MP-5 can help lower your acetylene costs. Ask for a descriptive folder. The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.

*Trade-Mark

SPECIFICATIONS

	MP-5 150-lb. size	MP-5 300-lb. size	MP-5 500-lb. size
Capacity 1/4x1/12-in. [Quarter Size] Union Carbide (lb.)	150	300	500
Generating Capacity (cu. ft. per hr.)	300	600	1000
Weight, Fully Charged (lb.)	2180	4240	6280
Weight, Shipping (lb.)	1190	1955	2540
Height, Overall (in.)	88	94	114
Diameter, Generating Chamber (in.)	43	60	60

Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES FROM LINDE UNION CARBIDE

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Telephone without Interference in This New Sound Absorbing Phone Booth

The clatter and roar of nearby machinery is completely absorbed in the Burgess Acousti-Booth. You can telephone in the noisiest factory without interference. The secret of the Acousti-Booth's quietness lies in the lining of Burgess Acousti-Pad—a patented product with a perforated metal facing backed with an efficient sound-absorbing material. As no door is needed, the booth is never stuffy. It is convenient to use and is easily cleaned. Burgess Acousti-Booth is constructed of steel to withstand rough service.

Burgess Model 201 Booth for noisy mills and factories.

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Please send specifications and prices of Burgess Acoustic Communication Booth

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Firm .....

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City ..... State .....

Give Unit Heaters a Break

(*Continued from page* 88)

floor. Blower units can be located as much as 40 to 50 ft. above the floor. Remember, however, that the higher a unit of either type is mounted, the less the area of effective coverage.

Fuel economy. In general, blower units will produce the greatest fuel economy. This applies particularly to large areas with high ceiling or roof and poor construction. In some instances, however, such as an intermediate floor of a multi-story building, it is questionable whether either type would show any advantage over the other, so far as fuel consumption is concerned.

Four factors affect and determine the average coverage area of a unit heater:

1. Outlet air velocity
2. Outlet air temperature
3. Distance from floor to discharge outlet
4. Degree of air deflection downward

As stated previously, outlet velocities range from 500 to 2,500 f.p.m. If the velocity is in the lower bracket, it is well to keep the temperature low—preferably not over 125 deg. F. It is equally important to keep the elevation of the unit above the floor line at a minimum—near the 9-ft. level.

At greater heights the air must be directed downward at a sharp angle in order to reach the working zone, and at low velocity and high temperature the air stream will not possess enough kinetic energy to pierce the cold layers of air and provide effective distribution.

If the velocity is in the upper bracket, it will permit the use of higher outlet temperatures, particularly where a large quantity of room air is induced into the primary hot air stream. Then outlet temperatures of 150 to 160 deg. F. are neither uncommon nor unsound. Also, it permits the location of the unit at high elevations when necessary because the air stream possesses sufficient kinetic energy to pierce the colder layers of air between the unit and the working zone.

Keep the significance of these four factors in mind when making an analysis prior to final selection.

I have found that the blow and

WIRE

Round—Flat—Half Round
Straightened and Cut Shape Wire

HIGH CARBON SPRING
OIL TEMPERED — LOW CARBON
BASIC OR BESSEMER
WELDING WIRE RODS AND COILS

Sizes ½" to No. 40 WM Gauge (.007)—All Finishes

Wire for Practically All Purposes and Requirements also SCREEN WIRE CLOTH

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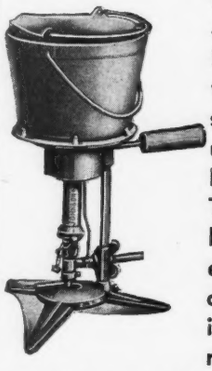
WIRE "SENECA"

The Seneca Wire & Mfg. Company
Fostoria, Ohio

Representatives and Warehouses in practically all principal cities

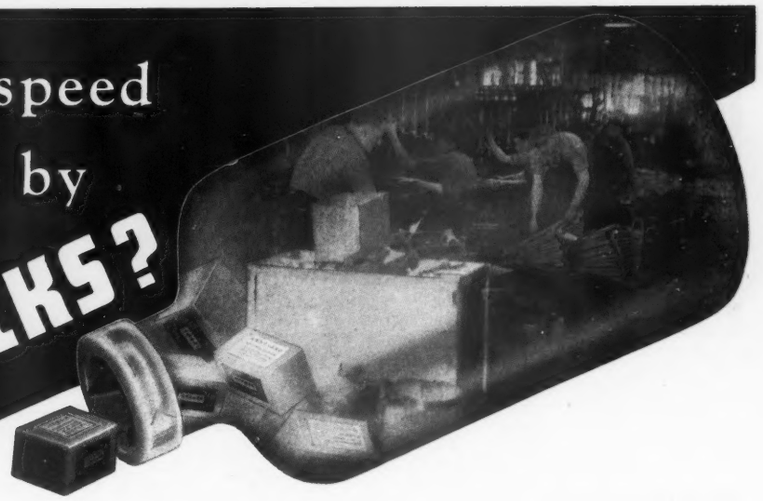
JOHNSON No. 8
Adjustable Torch and Melting Pot



Here's a very fine Johnson unit that is applicable to a wide variety of shop or laboratory uses. The Johnson No. 8 combined Torch and Melting Pot operates very efficiently for soldering, heat-treating or metal melting. A 22 lb. capacity removable pot and shield are furnished with this Torch. The powerful Johnson Bunsen Burner may be adjusted to any angle or removed for use as an efficient hand torch. Very economical to operate. Write for free circular.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

Is production speed s-l-o-w-e-d up by BOTTLE-NECKS?



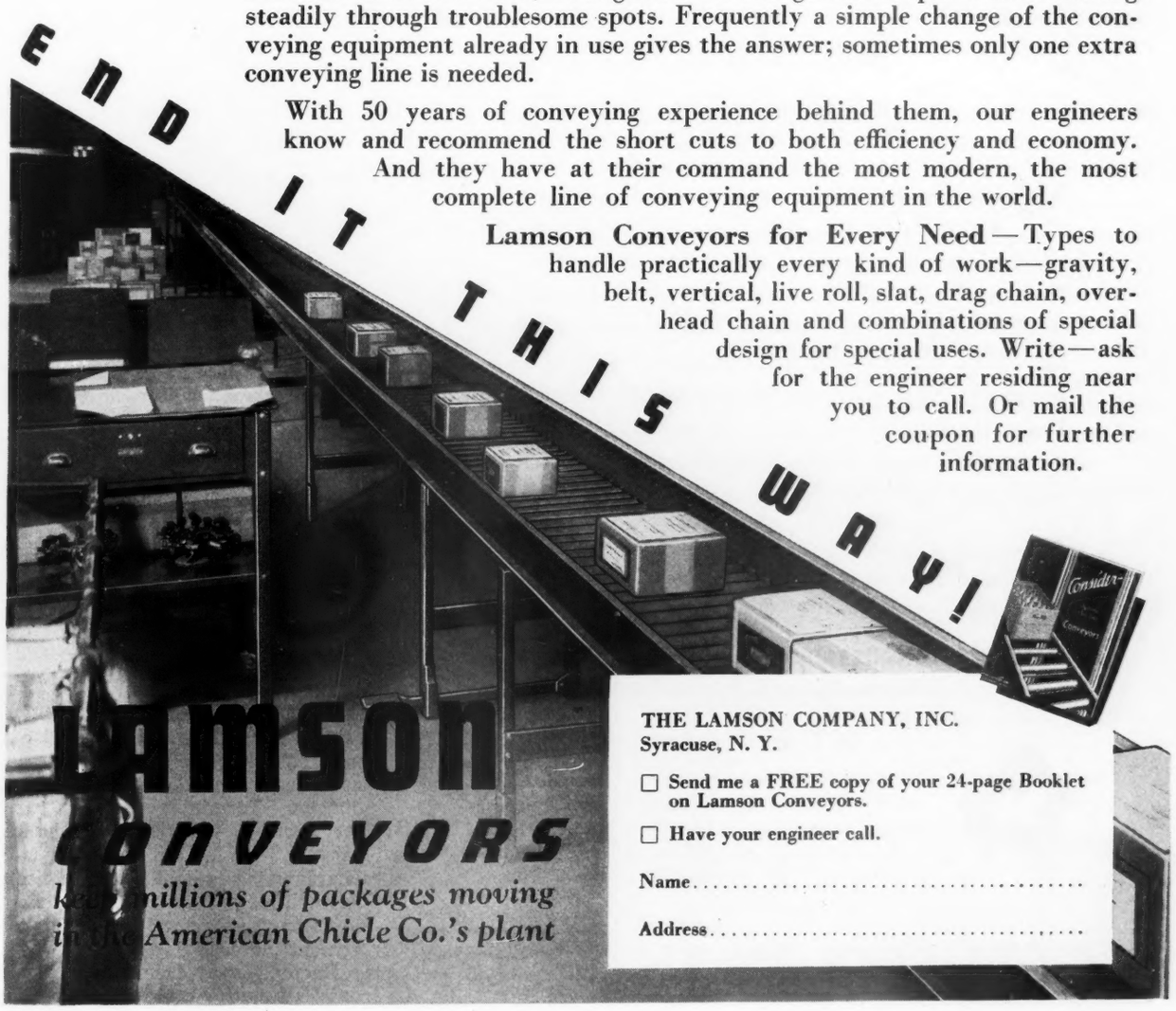
Slow-spots—the "bottle necks" that hold up the steady flow of materials in process—are costly in any production line. Nearly every plant has one or more. And the faster the rest of the plant works, the more these "bottle necks" slow the pace and reduce profits.

Lamson engineers have helped hundreds of plants to end "bottle necks" . . . have worked out fast, "straight line" routings that keep materials moving steadily through troublesome spots. Frequently a simple change of the conveying equipment already in use gives the answer; sometimes only one extra conveying line is needed.

With 50 years of conveying experience behind them, our engineers know and recommend the short cuts to both efficiency and economy. And they have at their command the most modern, the most complete line of conveying equipment in the world.

Lamson Conveyors for Every Need—Types to handle practically every kind of work—gravity, belt, vertical, live roll, slat, drag chain, overhead chain and combinations of special design for special uses. Write—ask for the engineer residing near you to call. Or mail the coupon for further information.

END IT THIS WAY!



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Syracuse, N. Y.

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No. 1000 – Interior; No. 5000 – Exterior; No. 2000 – Equipment; No. 7000–General Purpose Maintenance; No. 1110 – Heat Resisting; No. 1200 – Lacquer; No. 3000 – Baking; No. 6000 – Dipping; No. 8000 – Federal Specification.

"COSTS LESS BY THE FOOT"

coverage which may be expected from each class are as follows:

Blower Type

Distance of blow = 10 per cent of outlet velocity

Angle of spread = 20 deg.

Each 5-deg. downward depression of the outlet air stream reduces the distance of blow 4 per cent.

Propeller Type

Distance of blow = 7 per cent of outlet velocity

Angle of spread = 25 deg.

Each 5-deg. downward depression of the outlet air stream from the horizontal reduces the distance of blow 4 per cent.

These figures are based on a normal average outlet temperature of 125 deg. F., with the center of the outlet discharge 9 ft. above the floor.

As an example, assume that a propeller unit is mounted 9 ft. above the floor and has an outlet velocity of 1,000 f.p.m. What is the reasonable expected blow? Here distance of blow, B, equals 7 per cent of 1,000 = 70 ft.

Assume now that the unit is located at an elevation of 13 ft. and the downward deflection of the air is 20 deg. What flow can reasonably be expected?

7 per cent of 1,000 = 70 ft.

$20 \div 5 = 4 \times 4$ per cent = 16 per cent reduction

B = 70 — (16% of 70) = 59 ft.

It is assumed, of course, that downward projecting beams or other obstructions will not be in the direct line of blow.

Figure 2 illustrates the relative distance of blow for units under various conditions.

(In a succeeding article, to appear in an early issue, installation of unit heaters will be discussed. Ed.)

Applying Motor Controls

(*Continued from page* 81)

of motor controls. First, there should be plenty of space inside the cabinet for wiring. Sacrificing wiring space for the sake of compactness makes installation much more difficult. Terminals should be easily accessible so that good connections can be made without difficulty. Knockouts on all sides of the cabinet will make it possible for conduit to enter the starter in the most convenient place.

Keep oil away from control equipment as much as possible, especially

New...COMPLETE LINE

FRACTIONAL H. P. MOTORS

INCLUDING *NEW* FEATURES THE TRADE ASKED FOR

Single Phase • Polyphase • Direct Current

INDUSTRIAL • COMMERCIAL • DOMESTIC

Bulletin 1039 • Characteristics *and* Applications

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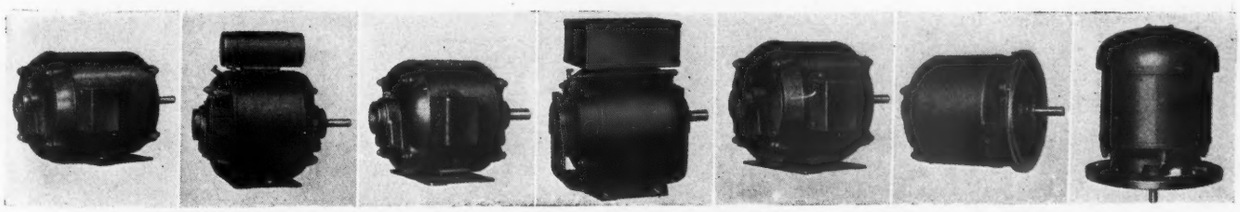

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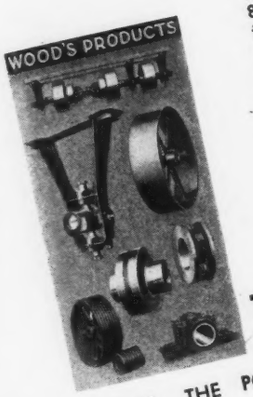
IS OUR STOCK IN TRADE

Superficially, we are manufacturers of power transmission devices. Yet, in the final analysis, our actual job is to apply to metals the fullest measure of the sound engineering talent and experience we have accumulated during 80 years of service . . . so that, whether the installation be a single WOOD'S coupling or a complete group drive, you are assured of long lived, power thrifty, completely satisfactory performance.

That, we have succeeded in doing.

We welcome your inquiry and the opportunity to show you what savings WOOD'S ENGINEERING can make. Write—



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MEMBER: THE POWER ENGINEERING ASSOCIATES

What **DO YOU** *pay for* **PAINT ?**

PRICE per gallon is an easy figure to quote, useful only when you know how many square feet a gallon will cover properly, and how long the paint will protect. Figured that way, the cheapest paint is likely to be the most expensive; the most expensive, not necessarily the cheapest.

True economy is measured by the cost of protection per square-foot-year, and that's how Dixon's Silica Graphite Industrial Paints show their superiority.

The very nature of the pigment gives Dixon's an outstanding advantage, for natural flake graphite is chemically inert and moisture repellant. Its thin, flat particles plate the surface with an armor of overlapping scales that adhere with remarkable tenacity. Silica, combined by nature with graphite, hardens and strengthens the coating; while pure, boiled linseed oil cements the whole into a coat that, in almost countless instances, has withstood the elements and industrial gases for periods as long as ten years.

There's true economy in Dixon's Silica Graphite Industrial Paints. Available in fourteen colors including aluminum. Write for Master Specification 44-B1.

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if it contains metal particles, because it may result in insulation breakdowns. When the oil hardens, as nearly all oil will in time, it may cause sticking of switches and relays. Where possible, conduit should be brought in from the bottom of the starter, rather than from the top, since it is possible that oil may run along the conduit and thus enter the inclosure.

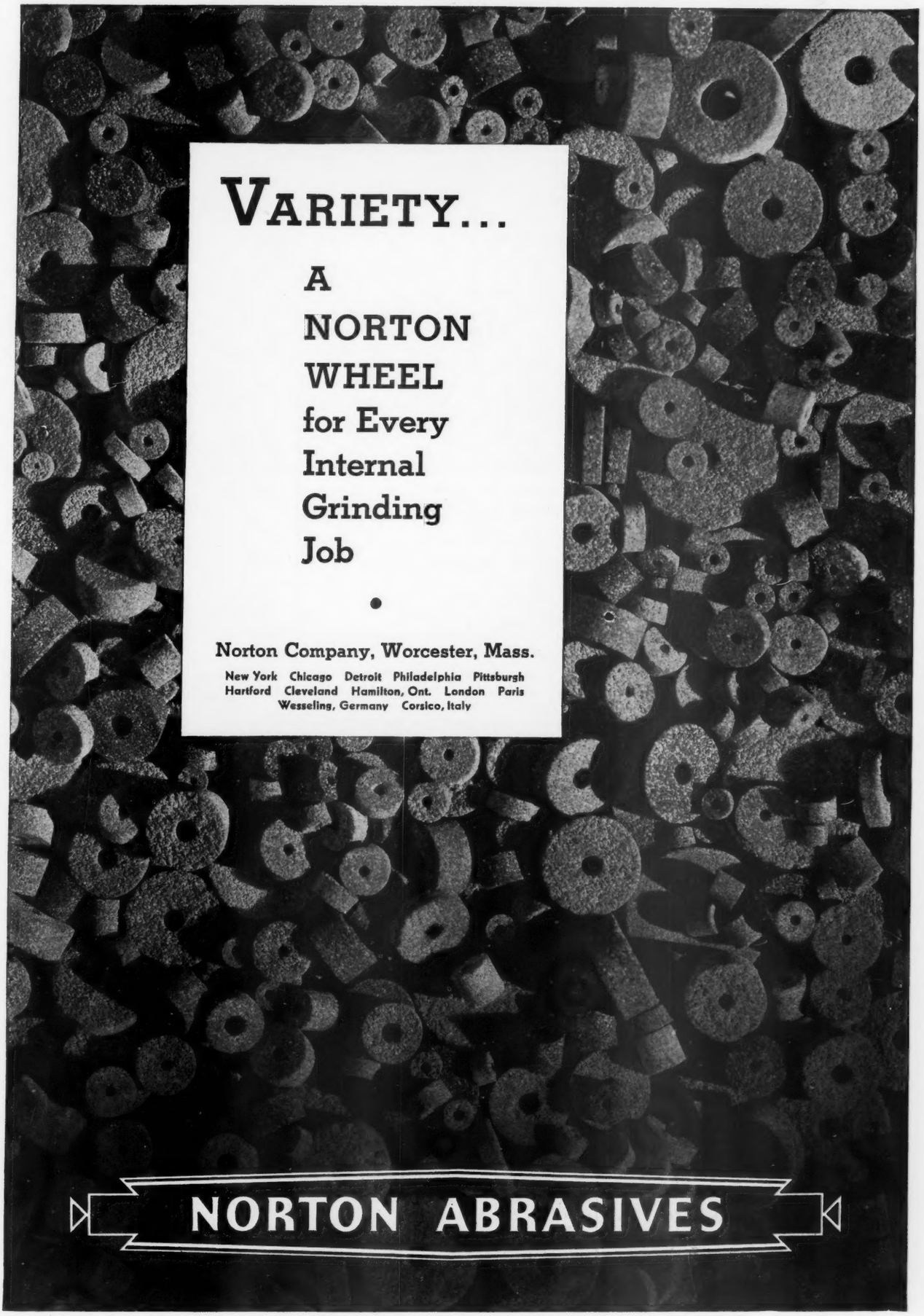
Years ago, when there were comparatively few motors in most plants, it was no great burden to make the rounds every week and file and clean the motor-starter contacts. Since then the number of motors in use has increased tremendously. Today many machines have one or more motors on them. To clean and file the contacts of the starters every week would be a staggering job. Therefore, machinery users demand, and get, motor starters that will operate throughout their entire useful life without regular attention.

What's the Cost?

Cost of maintaining equipment is, however, trifling in comparison with the possible cost of a production delay. One machine in a key position may hold up a large part of the entire plant. If one of the key motor starters on the main conveyor line in a large automotive assembly plant were to fail, a 10-minute shutdown might mean a difference of 40 cars in the day's output, at the alleged rate of four cars a minute. Again, certain can-making machines have as many as 25 motor starters. If one starter fails, the whole machine stops.

Under such circumstances, the importance of a motor starter should never be associated with its cost. There is no relation between the two. A $20 motor starter may control thousands of dollars' worth of equipment and a failure, if only for a few minutes, may mean a loss of many times the original cost of the starting equipment. If a small difference in the price of a motor starter will insure trouble-free operation, it is invariably a worthwhile investment. Many important production machines in the automobile industry have two sets of motor controls, one for normal operation and the other for standby service in the event of trouble.

Where a production machine has to be periodically overhauled, it is well to make a complete check-up of the control at the same time, and replace all worn parts. Between these check-up periods, there should be no trouble and no maintenance. The control is just as much a part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A
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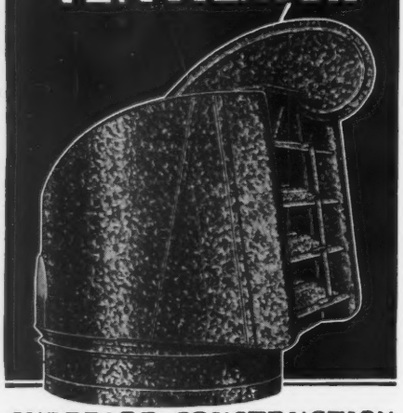
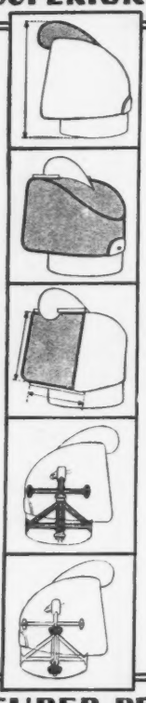
Again Swartwout Leads

with a NEW
Rotary
VENTILATOR



SUPERIOR CONSTRUCTION



Low slung vane — less overall height enhances appearance — holds ventilator absolutely steady in the wind.

New curved body—modern lines. Pleasing to look at. Provides the ultimate in efficient operation.

Oversize outlet provides extra large capacity under all operating conditions.

Steel elliptical tube interior construction *welded* into one-piece frame. Most rigid construction known.

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SUPER PERFORMANCE

For general factory ventilation — for removal of excessive heat, smoke fumes, moisture, and devitalized air —and for use wherever a roof ventilator is required—this new Swartwout Rotary will give you that *extra* satisfaction which comes only with a job *extra* well done. Swartwout Ventilation Engineers are available for consultation without obligation. Located in all principal cities. Write today for data.

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MORE AIR PER MINUTE PER DOLLAR

of the machine as the gears, pulleys, and cams, and should give the same trouble-free operation expected from these parts.

It is advisable to select starters whose component parts, or the entire unit, can be replaced in the shortest possible time. Merely locating the trouble, not to mention remedying it, usually causes a greater delay than replacing the unit. Furthermore, repairs are better made in the shop when the repairman has plenty of time. When making repairs on the machine, the workman is usually hurried and his work is slipshod, causing further shutdowns. In many plants this situation is recognized, and complete replacements are kept in stock. Then when trouble develops, as it does with the best of equipment, a reserve unit can quickly be installed and production delays kept to a minimum.

Prepare to Paint

(*Continued from page* 90)

trial importance than oxidation corrosion.

An alkaline solution is distinctly corrosion-retarding. Since it is impossible to exclude moisture entirely from all iron or steel surfaces, the best results can be secured by making sure that the film is basic or alkaline. That is the function of red or blue lead.

In this way they keep oxygen powerless to corrode the metal. Under a normal mild acid exposure, such as sulphurous fumes, the basic pigment in the paint tends to neutralize the acid and prevent the water film from becoming acidic. The basic pigment may eventually be consumed by the acid, and unless it is renewed corrosion may attack the metal beneath. However, it is cheaper to keep the surface painted with a basic paint than to permit corrosion to ruin the metal.

It is often found that a neutral or even mildly acidic paint has been used on a metal surface. Trouble follows, of course, and the plant executives, not knowing the simple principles of corrosion protection, blame either the painter or the manufacturer of the paint. To prevent corrosion, it is necessary to surface the metal with something fitted to the task.

To prepare a new steel surface, it is essential to remove all mill scale. Wire brushing or scraping sometimes suffice. Occasionally the sur-

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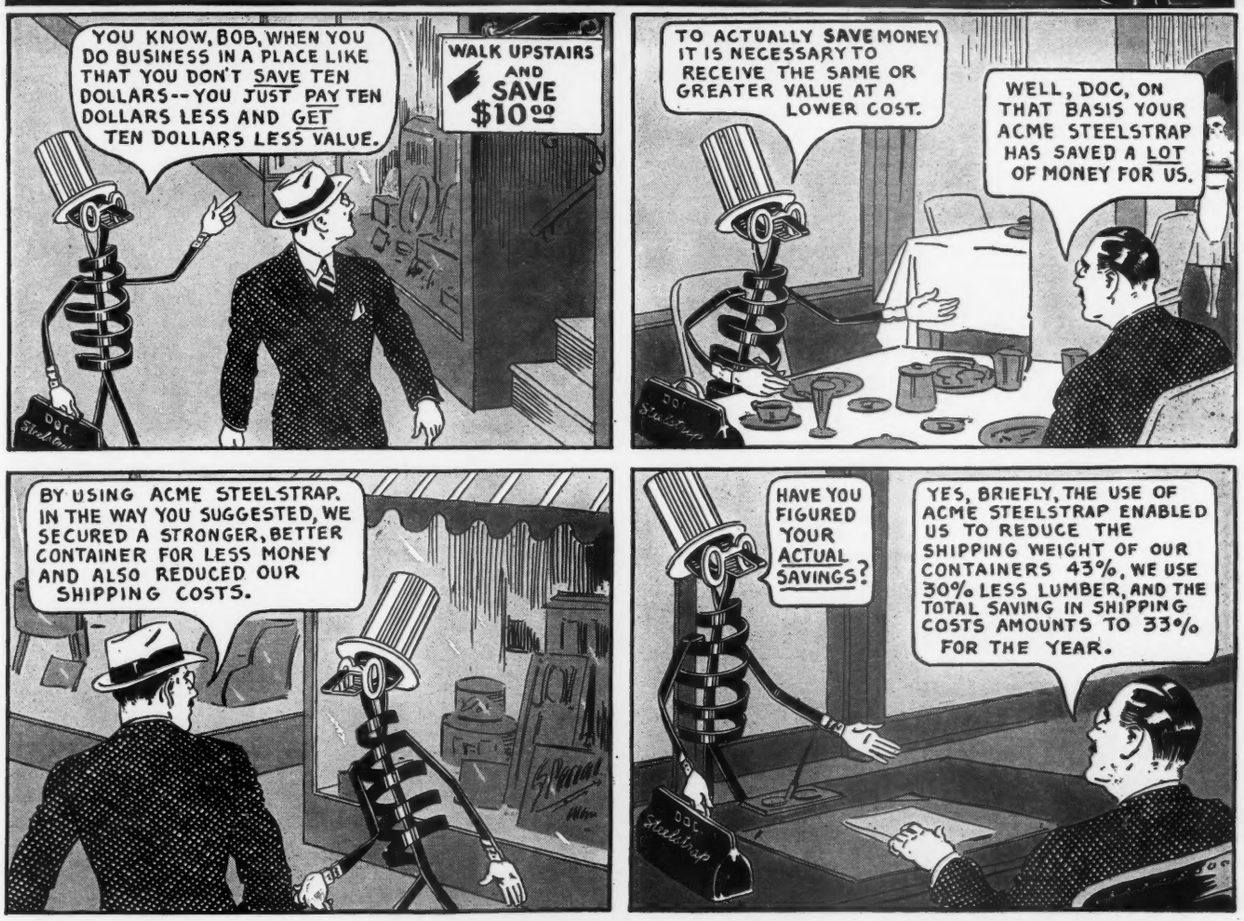
Doc. Steelstrap DISCUSSES SHIPPING ECONOMIES


YOU KNOW, BOB, WHEN YOU DO BUSINESS IN A PLACE LIKE THAT YOU DON'T SAVE TEN DOLLARS--YOU JUST PAY TEN DOLLARS LESS AND GET TEN DOLLARS LESS VALUE.
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YES, BRIEFLY, THE USE OF ACME STEELSTRAP ENABLED US TO REDUCE THE SHIPPING WEIGHT OF OUR CONTAINERS 43%, WE USE 30% LESS LUMBER, AND THE TOTAL SAVING IN SHIPPING COSTS AMOUNTS TO 33% FOR THE YEAR.

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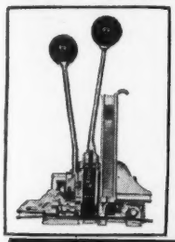
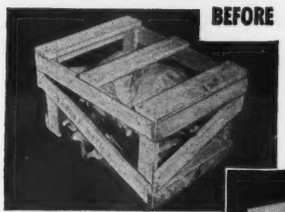
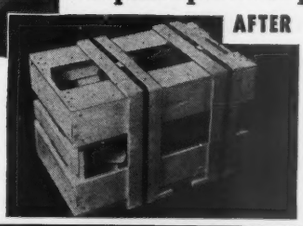
Below: Acme's new Magazine Feed Steelstrapper.



Right: One of the hundreds of examples of Acme Steelstrap savings—28% reduction in *weight*, 27% reduction in *cost*. Savings can be effected regardless of size, shape or type of container.





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☐ **Mail a copy of the illustrated booklet "My Second Strap-Book."**

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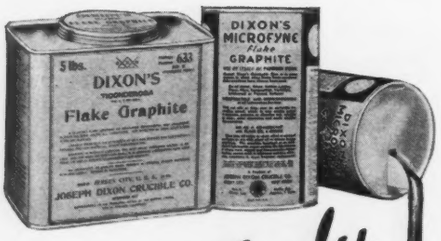

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face requires hammering to loosen scale that would break away later. Where all traces of mill scale must be removed, sandblast and paint at once before oxidation occurs, which is a matter of hours.

Etching the Surface

After preparing the surface, a blue or red lead primer should be applied to the bare metal. Over these surfaces, any desired color or type of paint may be used.

Galvanized sheets present a special problem, although some manufacturers put out a specially treated galvanized sheet that is ready for painting. Otherwise it is best to allow such metal to weather for six months or a year.

When time does not permit natural weathering, the surface may be prepared by brushing it with a solution of 4 oz. of copper acetate or copper sulphate to a gallon of water. This mixture etches the galvanized surface. In about an hour wash the surface thoroughly with clear water. When the surface is completely dry, apply a red or blue lead paint.

Old galvanized surfaces on which the zinc coating is broken and corrosion or rusting has started, should be protected with a rust-inhibitive paint.

Special vehicles that resist acid or alkali, moisture, or high temperatures are available. These conditions are a real problem in some plants; if not combated by the use of a resistant paint, the coating may fall off when the oil burns out Most of these resistant paints use tung oil; many have synthetic types of vehicles.

Pipe lines, particularly underground, may require special treatment. Asphalt and coal tar paints are commonly employed to prevent underground corrosion. Where electrolysis can occur from escaping electric current, corrosion may be almost unavoidable. Sometimes pipes are wrapped in paper or other materials, in addition to the paint coating.

The character of the soil has considerable influence on corrosion underground, some portions of the country being far worse than others in this respect. Anyone having this particular problem should seek the advice of a recognized authority, preferably one who has no axe of his own to grind.

Tin plate, such as is used for roofing, requires prompt and competent care to prevent corrosion. Pinholes are always present in the coating, and moisture thus gets at the underlying metal. Before painting it is

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Picture an ocean liner tossing on a heavy sea. What protects the rudder and the rudder post from damage caused by the pounding of the waves? Just this: the rudder is swung through a tiller driven by powerful hydraulic rams. These rams are operated by Fluid Power, generated by a Hele-Shaw pump. The fluid power medium —oil—behind the hydraulic rams, acts as a *cushion* against excessive shocks and stresses on the rudder.

The ability of a Hele-Shaw Fluid Power system to cushion shocks is used with equal effectiveness in hydraulic presses and many other machines developing huge forces. Cushioning is a big advantage of driving machinery by Hele-Shaw Fluid Power. It is, however, only one of many advantages of Fluid Power. It will be to your advantage to find out all you can about Fluid Power for producing variable, reversible linear or rotary motion. Our engineering department will gladly help you, or you can write for our complete catalog F.

The Motorship *City of New York*, whose steerer is illustrated above, recently logged 125,000 miles—plying between New York and South Africa. Her A-E-CO Hydraulic Steerer, and the A-E-CO Hele-Shaw Pumps driving it, performed without a hitch in operation.

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Other Products: A-E-CO Taylor Stokers, A-E-CO Lo-Hed Monorail Electric Hoists, A-E-CO Marine and Yacht Auxiliaries

advisable to rub the surface with turpentine or benzine to remove the palm oil that is always present.

Iron oxide paints containing an inhibitive pigment are widely used for preserving tin plates.

Smokestacks and other metal surfaces subjected to high temperatures are troublesome. Blue lead or red lead followed by aluminum are satisfactory in most places where the temperature does not exceed 450 or 500 deg. F. Above this temperature, it is difficult to obtain paint which will last long. Asphalt will sometimes withstand a somewhat higher temperature. In any event, at the higher temperatures it is not a matter of obtaining a long-lived paint, but rather the vehicle which will longest withstand the heat. When the vehicle burns out, the pigment drops off.

•

TRADE LITERATURE

Acoustical Materials—Booklet, title "Less Noise—Better Hearing," 1937 edition.—The Celotex Corp., 919 North Michigan Ave., Chicago.

Air Eliminator—Bulletin No. 104, on high pressure air eliminator.—Gorton Heating Corp., Cranford, N. J.

Bearings—Booklet, describing line of bearings.—The Fast Bearing Co., Hampden Ave. and 23rd St., Baltimore.

Boiler—Booklet, describing the C-E Nuway boiler, a fire tube boiler.—Combustion Engineering Co., Inc., 200 Madison Ave., New York.

Boiler Compound—Bulletin, on Buromin, a compound for conditioning boiler water.—The Buromin Co., 600 Bowman Bldg., Pittsburgh.

Calking Compound—Folder, on calking compound for waterproofing buildings.—The Truscon Laboratories, Detroit.

Condensate Return—Bulletin No. 1972-B, describing Cameron Motorpump condensate return unit.—Ingersoll-Rand Co., 11 Broadway, New York.

Diesel Engine—Bulletin No. 768, on Type 8 diesel engine for continuous heavy duty.—Chicago Pneumatic Tool Co., 6 East 44th St., New York.

Drive—Bulletin 22, on Ajax-Shaler Shaker and Purifier Sieve Drive.—Ajax Flexible Coupling Co., Westfield, N. Y.

Duplicating—Booklet, title "How Standard's Direct Process Lowers Copy Costs."—Standard Mailing Machines Co., Duplicating Machines Division, Everett, Mass.

Electrical Distribution—Booklet, describing BUStribution system of electrical distribution.—Bull Dog Electric Products Co., 7610 Jos. Campau Ave., Detroit.

Electrical Equipment—Catalog, on line of distribution equipment, switches, panels, etc.—Bull Dog Electric Products Co., Detroit.

Electrical Steel Sheets—Bulletin, describing electrical steel sheets.—Carnegie-Illinois Steel Corp., Pittsburgh.

Employee Relations—Booklet, title "How to Win Workers and Influence Profits."—Spies Brothers, Inc., 1140 Cornelia Ave., Chicago.

Enamels—Two bulletins: one on chip-proof Flexible Blue Knight enamels; one on Flexible "No-Finger-Print" Taupe Finish.—Roxalin Flexible Lacquer Co., Inc., Elisabeth, N. J.

Feed Water Heaters—Bulletin D-4, on

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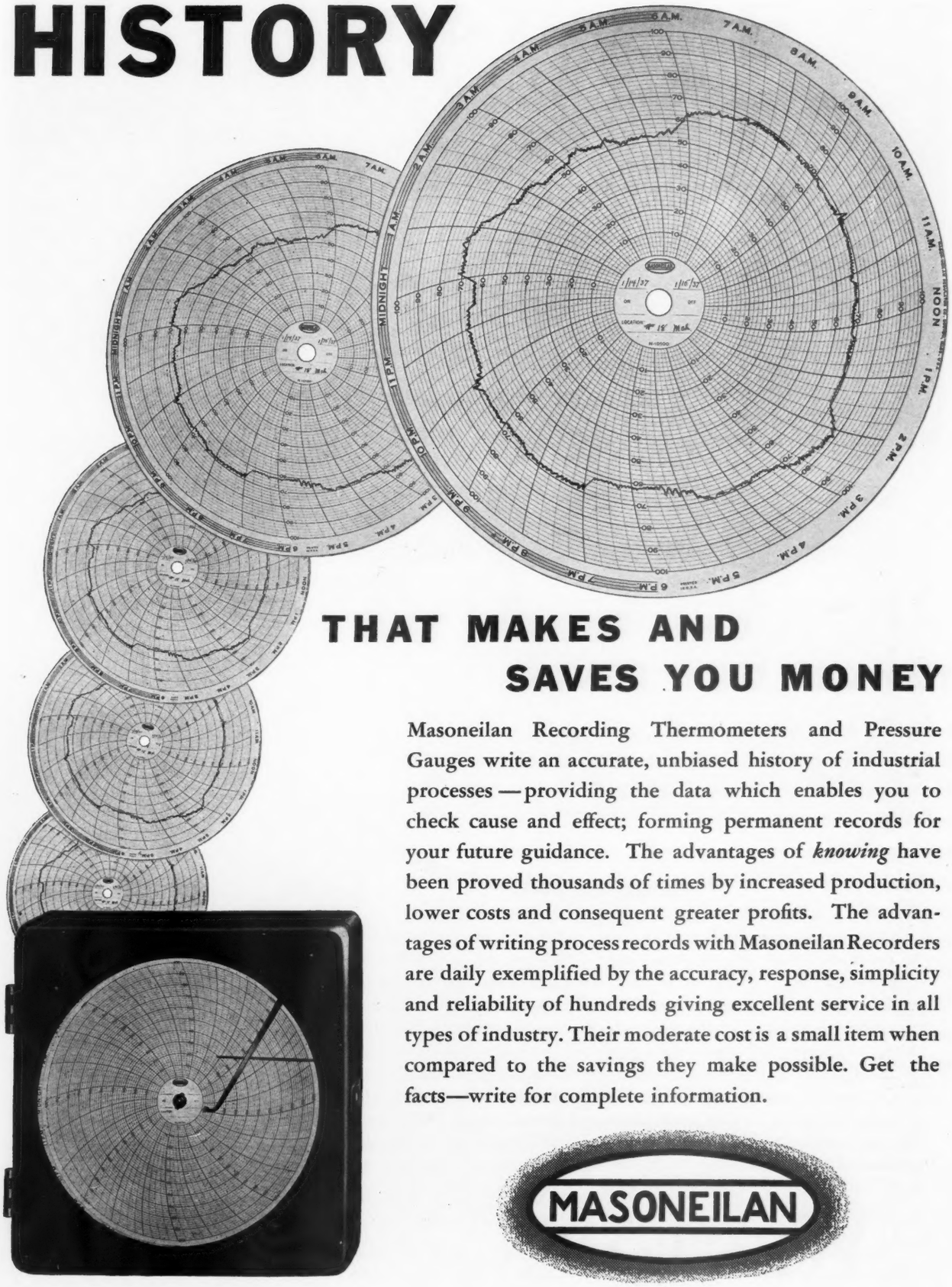

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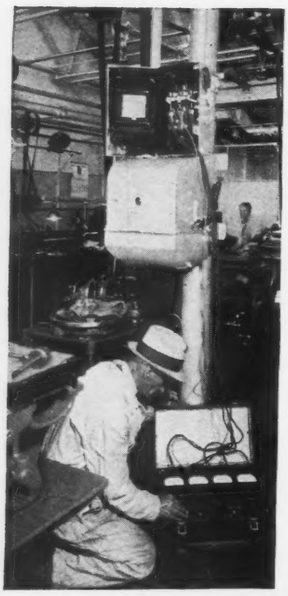

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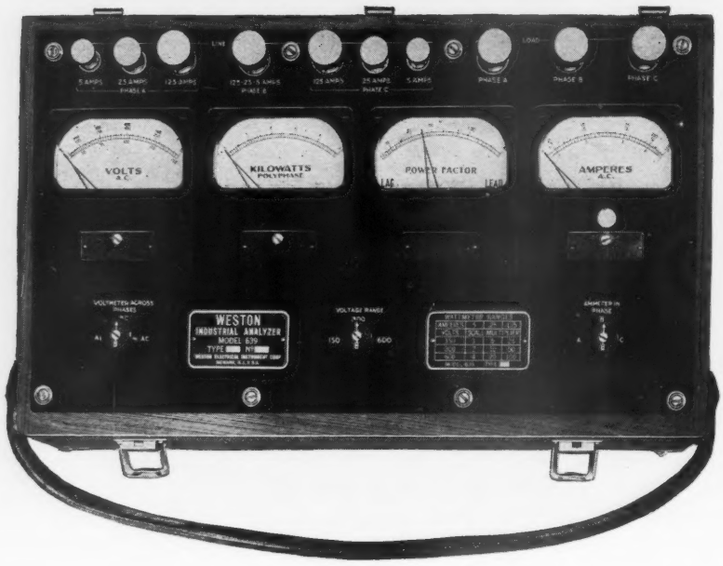

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WESTON *Instruments*

direct-contact feed water heaters, deaerating and non-deaerating.—Elliott Co., Jeannette, Pa.

Fuel Dehydrator—Folder, describing new process for neutralizing acid and drying out moisture in fuel oils.—Cunningham Co., 4252 Santa Monica Blvd., Los Angeles.

Galvanizing—Booklet, title "A Guide to Longer Life," showing merits of the hot dip galvanizing process.—American Hot Dip Galvanizers Association, Inc., 903 American Bank Bldg., Pittsburgh.

Instruments—Catalog section 43-600, describing line of detachable instruments.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Lamps—Bulletin No. 520, on improved horizontal Cooper Hewitt lamps.—General Electric Vapor Lamp Co., Hoboken, N. J.

Lighting Equipment—Catalog No. 20-B, on line of lighting equipment.—Smoot-Holman Co., Inglewood, Calif.

Lightning Arresters—Catalog No. 390, on Crystal Valve lightning arresters.—Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia.

Materials Handling—Catalog No. 3-F, on Diamond Fibre Hollow Ware for materials handling.—Continental-Diamond Fibre Co., Newark, Del.

Metal Working—Thirty-third edition of "How to Run a Lathe." 25¢. South Bend Lathe Works, South Bend, Ind.

Moisture Determinations—Folder, on the Moisture Teller, an instrument for moisture determination.—Harry W. Dietert Co., 9330 Roselawn Ave., Detroit.

Motors—Two bulletins: 1032, on slip ring motors of 1-350 hp.; 1033, on d.c. motors of 1-300 hp.—Century Electric Co., 1806 Pine St., St. Louis.

Oakland, Calif.—Booklet, telling what Oakland has to offer industry.—Metropolitan Oakland, 340 Financial Center Bldg., Oakland, Calif.

Paint—Folder, on Bondlite paint for interior painting.—The Wilbur & Willaims Co., Park Square Bldg., Boston.

Pumps—Bulletin L-711-B2, on single- and two-stage horizontal dry vacuum pumps.—Worthington Pump and Machinery Corp., Harrison, N. J.

Pumps—Two bulletins: 61-B10, on Type RF 3-lobe Cycloidal pump; 55-B10, on application of certain units as exhausters for priming large centrifugal pumps.—Roots-Connersville Blower Corp., Connersville, Ind.

Pyrometer—Bulletin No. 91-1, on the Brown Optomatic System, an automatic optical pyrometer.—The Brown Instrument Co., Wayne & Roberts Aves., Philadelphia.

Pyrometers—Bulletin, on Round-Chart Potentiometer Pyrometers for temperature recording and controlling.—The Bristol Co., Waterbury, Conn.

Roofs—Booklet, on bonded built-up roofs.—Johns-Manville, 22 East 40th St., New York.

Rubber Clothing—Leaflet, on rubber gloves, boots, aprons for electroplaters.—The Udylite Co., 1651 East Grand Blvd., Detroit.

Scaling Tool—Bulletin 84, announcing Cleco Bl scaling tool.—The Cleveland Pneumatic Tool Co., 3734 East 78th St., Cleveland.

Shims—Catalog, on Laminum precision adjustment shims.—Laminated Shim Co., Inc., 2124 44th Ave., Long Island City, N. Y.

Skid Platforms—Folder No. 146, on skid platforms.—Lewis-Shepard Co., 175 Walnut St., Watertown, Mass.

Speed-Measuring Instruments—Bulletin 1505, describing line of tachometers and speed indicators.—James G. Biddle Co., 1211-13 Arch St., Philadelphia.

Sprockets—Bulletin 60, on Standard Hub Sprockets for single, double, and triple roller chain.—Baldwin-Duckworth Chain Corp., Springfield, Mass.

Steel—Book, describing line of tool, stainless, carbon, and alloy steels.—Ludlum Steel Co., Watervliet, N. Y.

Stokers—Bulletin 4026, on Poweram underfeed stokers.—Iron Fireman Mfg. Co., 1370 West 106th St., Cleveland.

Tool Blanks—Catalog M-37, on Carboloy standard tools and blanks.—Carboloy Co., Inc., 2985 East Jefferson Ave., Detroit.

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Tools—Catalog No. 37, on line of saws, saw blades, mallets, and screwdrivers.—The Forsberg Mfg. Co., Bridgeport, Conn.

Welding—Booklet, title "Pictorial of Welding Progress."—The Lincoln Electric Co., Cleveland.

Tramrails—Folder, on carriers with motor-operated hoists.—The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

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BOOKS

TECHNOLOGICAL TRENDS AND NATIONAL POLICY

Report of the Subcommittee on Technology to the National Resources Committee. Superintendent of Documents, Washington, D. C. 388 pages. $1.

This monumental report, the first on the science resources of the United States, deals with the new inventions and their social implications, and calls attention to the need for planning and constant revision of national policies to meet new situations caused by technological advance. Prepared by a large group of scientists and engineers, it surveys the great fields of technology and applied science, and attempts to show what effect inventions in those fields will have on living and working conditions in the next 20 years.

HOW PROFITABLE IS BIG BUSINESS?

Alfred L. Bernheim, Editor. Twentieth Century Fund, Inc., 330 West 42d St., New York. 201 pages. $2.

Result of a two-year study by a group of economists, this volume is a factual report presented in a non-technical manner. It gives the story of both large and small corporations and considers the comparative profitableness of the two. All indices of success from net profit to dividends are covered.

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Donald A. Laird, Ph.D., Sci.D., Rivercrest Laboratory, Hamilton, N. Y. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 316 pages, illustrated, index. $4.

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ON THE CALENDAR

AUGUST

25-28, Silver Bay Conference on Industrial Relations, Silver Bay, N. Y. Charles A. Herschleb, 347 Madison Ave., New York.

29-Sept. 2, Leipzig Trade Fair, Fall Session, Leipzig, Germany. Leipzig Trade Fair, Inc., 10 East 40th St., New York.

31-Sept. 3, American Institute of Electrical Engineers, Pacific Coast Convention, Spokane, Wash. H. H. Henline, Secretary, 33 West 39th St., New York.

SEPTEMBER

23-25, National Industrial Advertisers Association, Inc., 1937 Conference, Chicago. Miss Mildred R. Webster, Headquarters Secretary, 100 East Ohio St., Chicago.

OCTOBER

4-9, Chicago Exposition of Power and Mechanical Engineering, Chicago. Charles F. Roth, Vice-President, International Exposition Co., 480 Lexington Ave., New York.

11-15, National Safety Council, Annual Meeting, Kansas City, Mo. W. H. Cameron, Secretary and Managing Director, 20 North Wacker Drive, Chicago.

18-22, American Society for Metals, National Metal Congress and Exposition, Atlantic City, N. J. W. H. Eisenman, Secretary, 7016 Euclid Ave., Cleveland.

24-29, National Electrical Manufacturers Association. Annual Meeting, Chicago. W. J. Donald, Managing Director, 155 East 44th St., New York.